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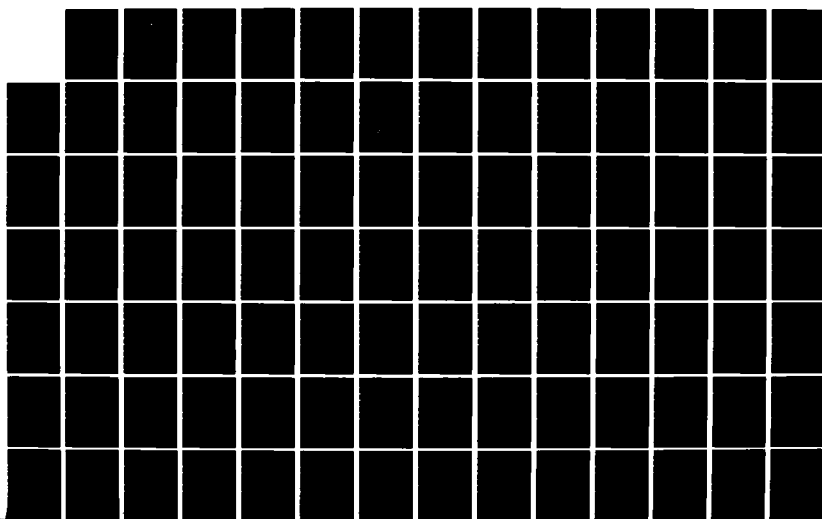
HELICOPTER FLYING QUALITIES CHARACTERISTICS-CH-46E  
VOLUME 3(U) BOEING VERTOL CO PHILADELPHIA PA 03 OCT 83  
NADC-81118-60-VQL-3

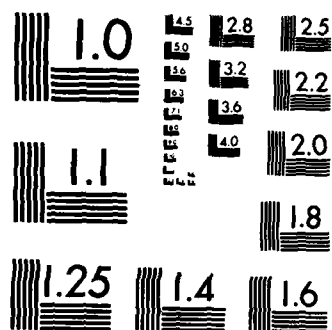
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MICROCOPY RESOLUTION TEST CHART  
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REPORT NO. NADC-81118-60



## HELICOPTER FLYING QUALITIES CHARACTERISTICS-CH-46E VOLUME 3

BOEING VERTOL CO.  
Boeing Center, P.O. Box 16858  
Philadelphia, PA 19142

3 OCTOBER 1983

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Warminster, PA 18974

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER NADC-81118-60	2. GOVT ACCESSION NO. A134 322	3. RECIPIENT'S CATALOG NUMBER
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17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number)  CH-46E; Helicopter; Flying Qualities		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number)  This document defines the flying qualities characteristics of the CH-46E helicopter. The data are representative of both the metal-bladed and composite-bladed versions. Analytically computed static trim data are presented for a wide range of configurations (gross weight, c.g.) and flight conditions (airspeed, altitude, sideslip, climb, autorotation). Correlation of trim data with available flight test data is provided for validation. (see next page)		

20. ABSTRACT (continued)

Analytically computed static stability and control derivatives are compiled for significant combinations of configuration and flight condition. Time history data relating to dynamic stability, control response and SAS failures are extracted from flight test records obtained during the Contractor's CH-46E SLEP II flight test program.

VOLUME 3  
CH-46E SLEP II TIME-HISTORY DATA

This Volume contains transient time-history data extracted from the CH-46E SLEP II flight test program conducted at the Boeing Vertol flight test facility at Wilmington, Delaware from 20 June to 31 October 1977. A catalog of the time-histories available is given on Page 2. Four general types of data record are presented:

- Dynamic stability (longitudinal pulse response);
- Control responses (longitudinal, lateral and directional step response);
- SAS failure (longitudinal, lateral and directional hard-over SAS input);
- Engine failure (single engine step reduction to ground idle)

In each record, the response of the helicopter in the axis of disturbance (control input, SAS failure, etc.) is thoroughly described by time-histories of six to eight relevant parameters in that axis, while interaxis coupling is assessed by a sampling of four parameters from each of the remaining axes.

The number of time-history plots presented herein is less than the total number of such records obtained by telemetry during the actual flight test program. Due to a built-in 3 to 5 sec delay between the pilot "record-on" command and the start of the aircraft tape record, the initial part of some maneuvers was not recorded on the aircraft tape. These records are therefore omitted from this report.



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CATALOG OF TRANSIENT TIME-HISTORIES  
CH-46E SLEP II FLIGHT TEST

GW = 24300 lb

CG = 6 in. fwd

<u>DYNAMIC STABILITY</u>			<u>Page</u>
Figure 1	Fwd Pulse	Hover, IGE	4
Figure 2	Aft Pulse		12
Figure 3	Fwd Pulse	119 kt, 3200 ft	20
Figure 4	Aft Pulse		28

<u>CONTROL RESPONSE</u>			
Figure 5	Fwd Stick Step	Hover, IGE	36
Figure 6	Aft Stick Step		44
Figure 7	Fwd Stick Step	116 kt, 4500 ft	52
Figure 8	Aft Stick Step		60
Figure 9	Right Stick Step	Hover, IGE	68
Figure 10	Right Stick Step	118 kt, 4860 ft	75
Figure 11	Left Stick Step		82
Figure 12	Right Pedal Step	Hover, IGE	89
Figure 13	Left Pedal Step		96
Figure 14	Left Pedal Step	104 kt, 4570 ft	103

<u>SAS FAILURE (DUAL-TO-SINGLE)</u>			
Figure 15	Nose Down Failure	134 kt, 3290 ft	110
Figure 16	Nose Up Failure		118
Figure 17	Roll Left Failure	136 kt, 3080 ft	126
Figure 18	Yaw Right Failure	132 kt, 3240 ft	133
Figure 19	Yaw Left Failure		140

SAS FAILURE (SINGLE-TO-NONE)

Page

Figure 20	Nose Down Failure	115 kt, 3140 ft	147
Figure 21	Nose Up Failure		155
Figure 22	Roll Right Failure	117 kt, 3200 ft	163
Figure 23	Roll Left Failure		170
Figure 24	Yaw Right Failure	112 kt, 3100 ft	177

ENGINE FAILURE (DUAL-TO-SINGLE)

Figure 25	No. 1 Engine Failure	137 kt, 3090 ft	184
Figure 26	No. 1 Engine Failure		194



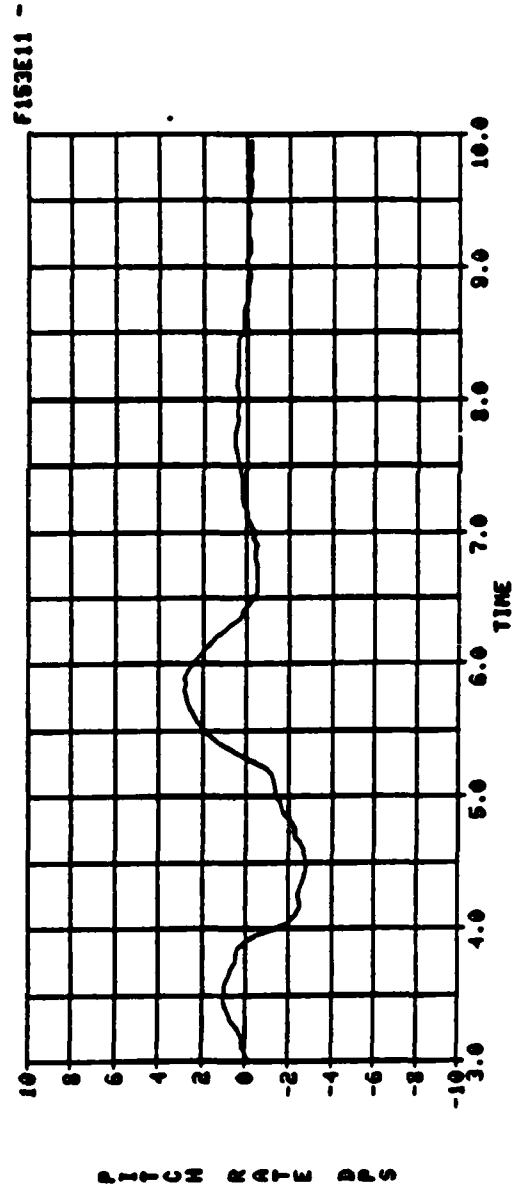
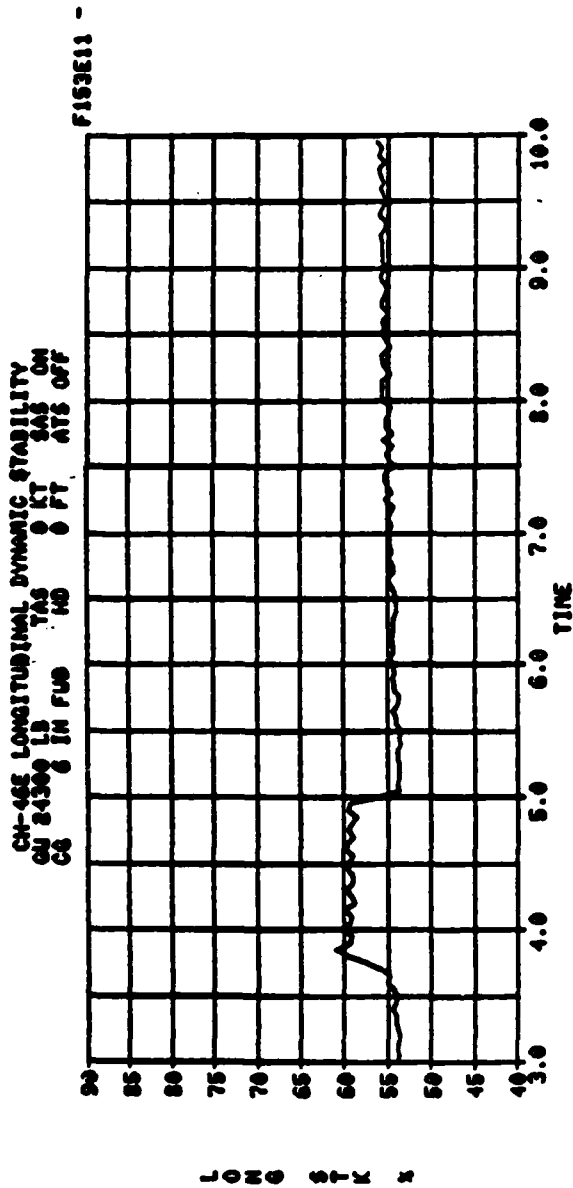


FIGURE 1A

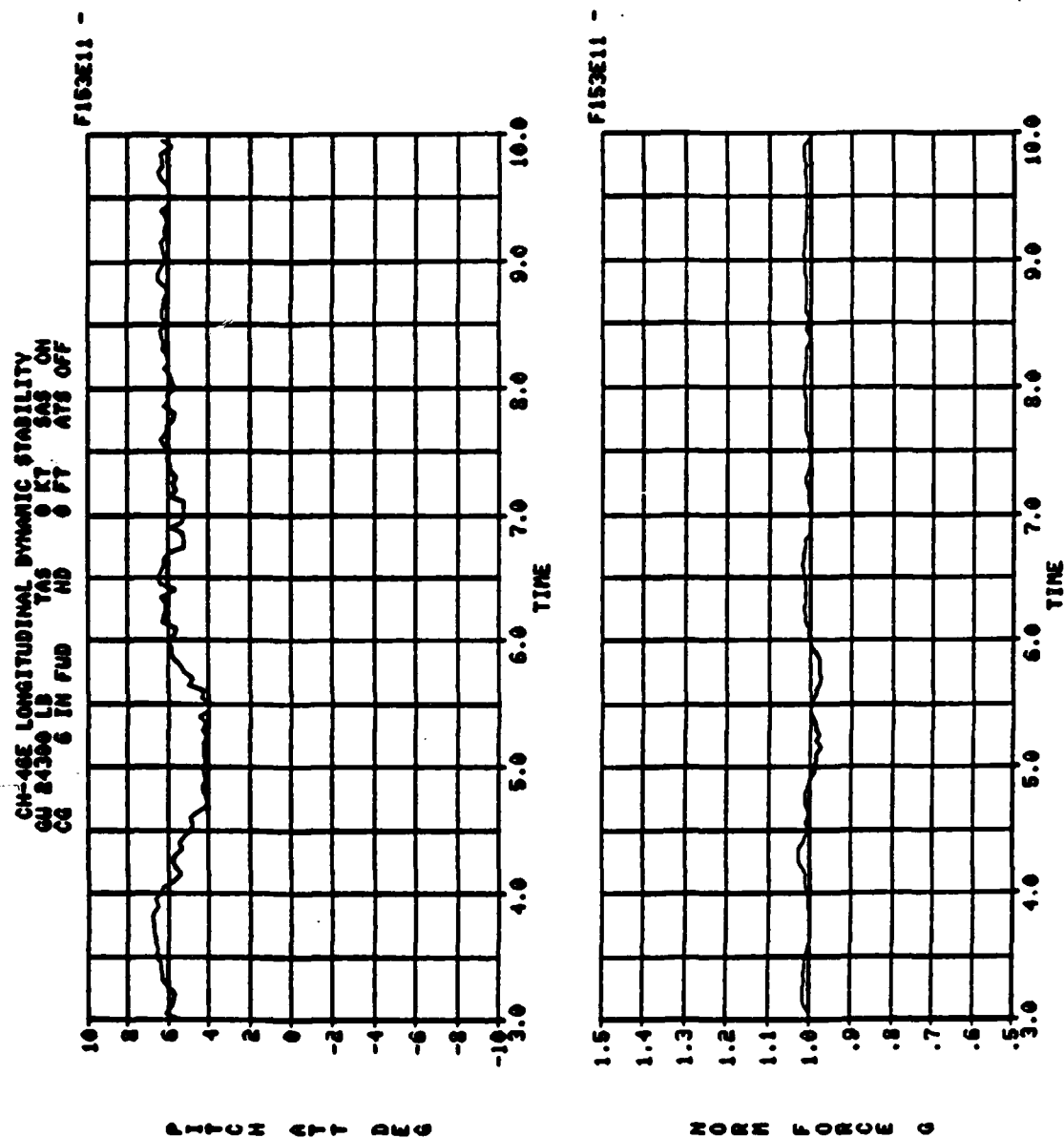


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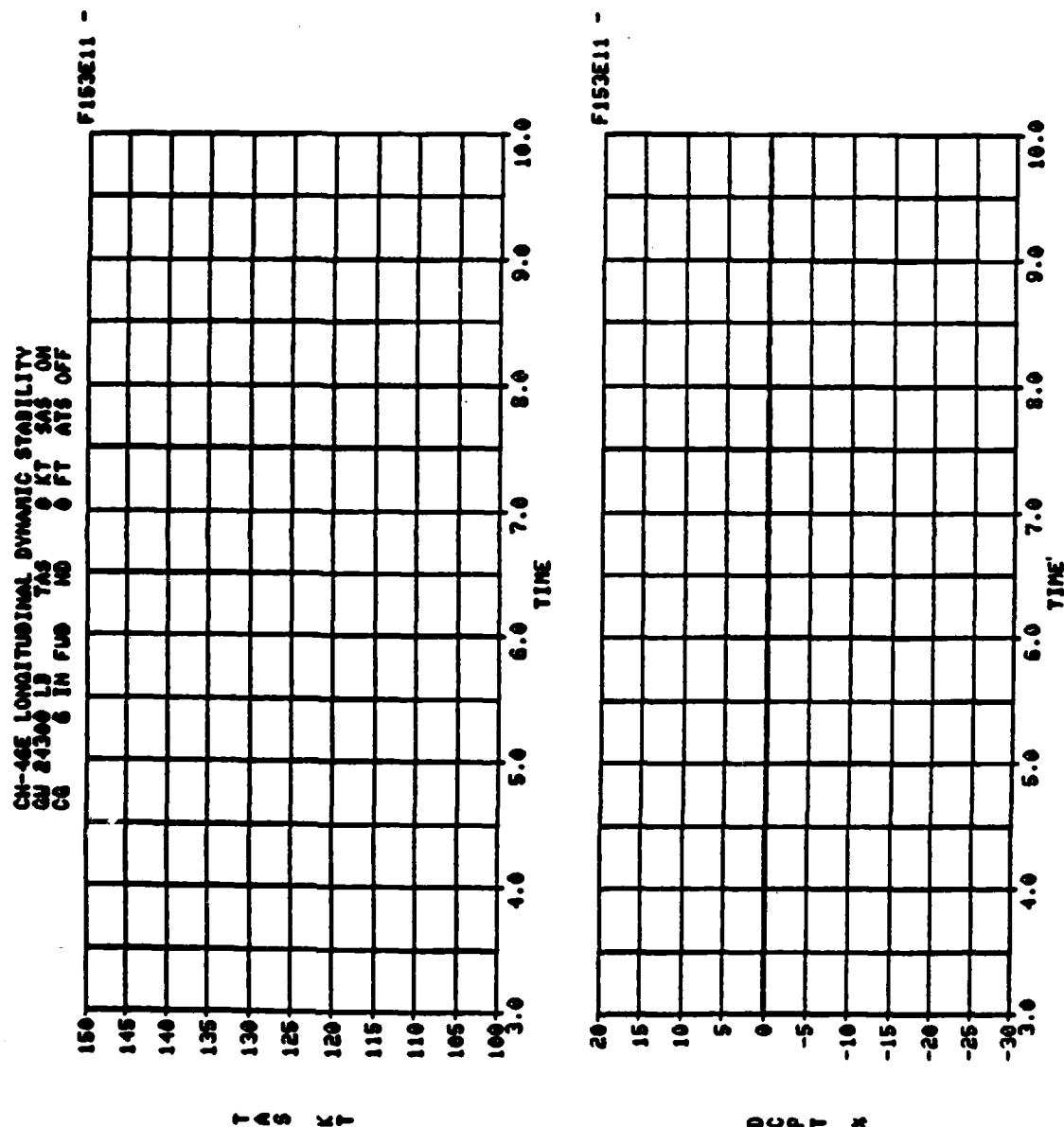


FIGURE 1C

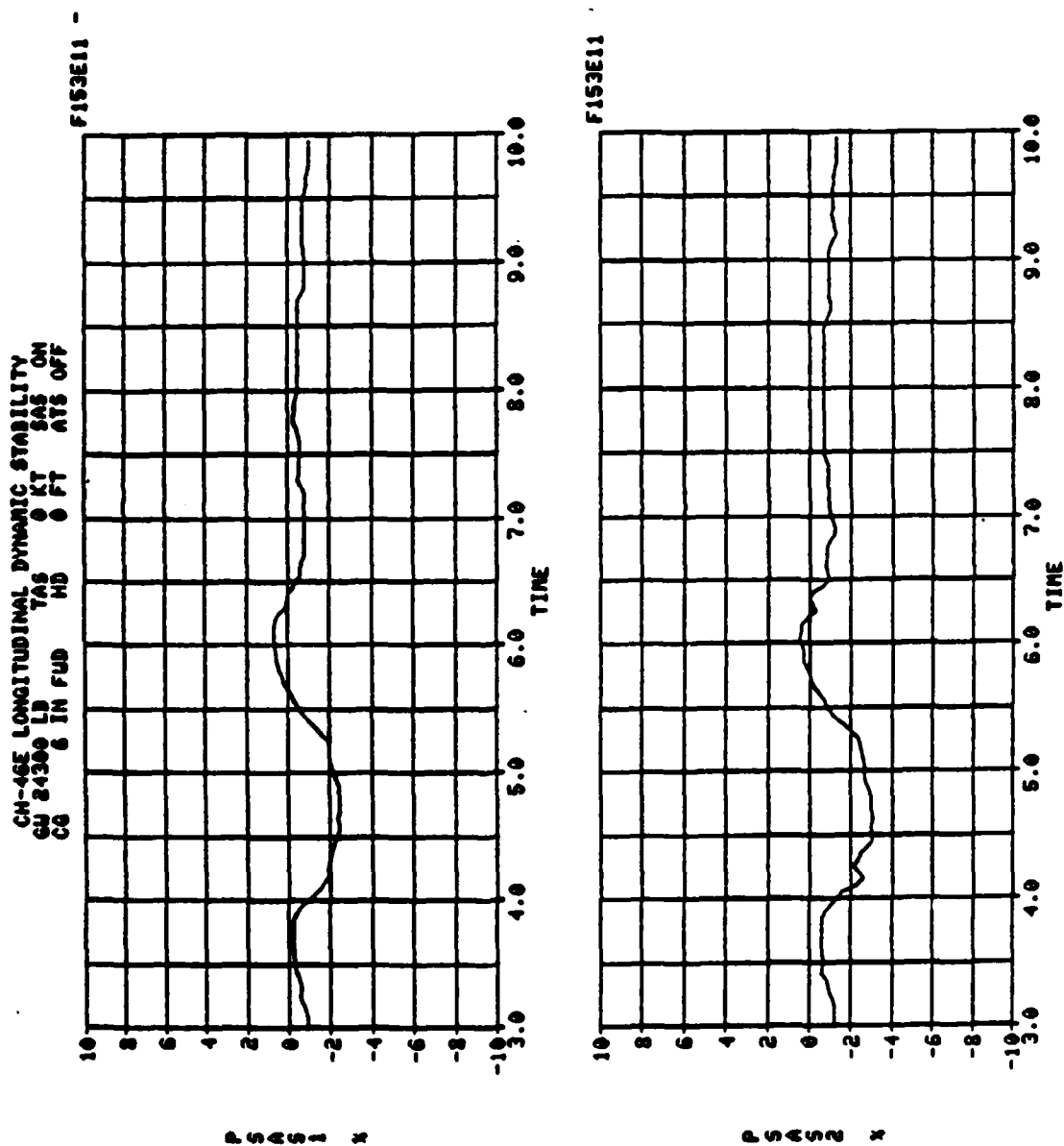


FIGURE 1D

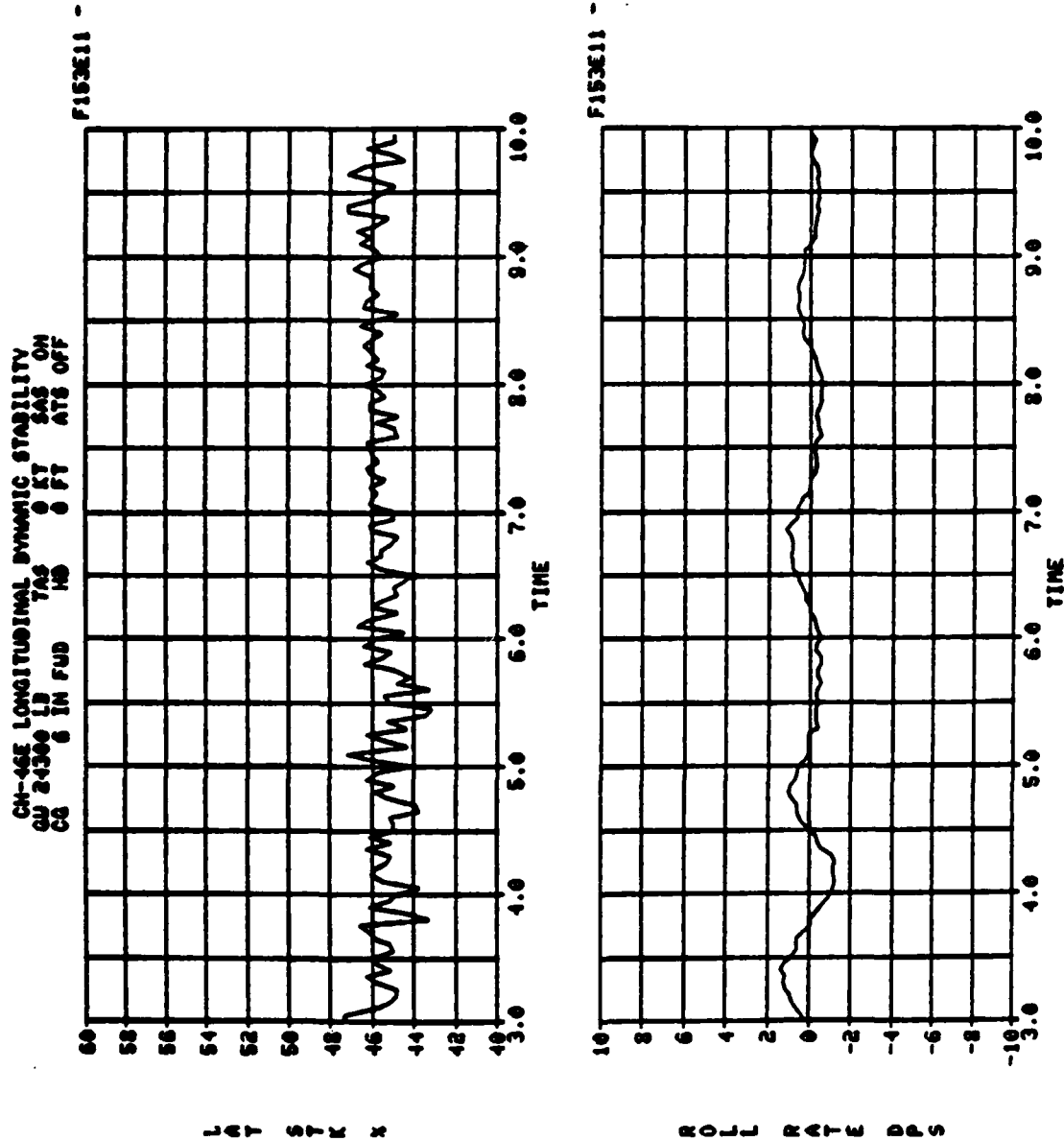


FIGURE 1E

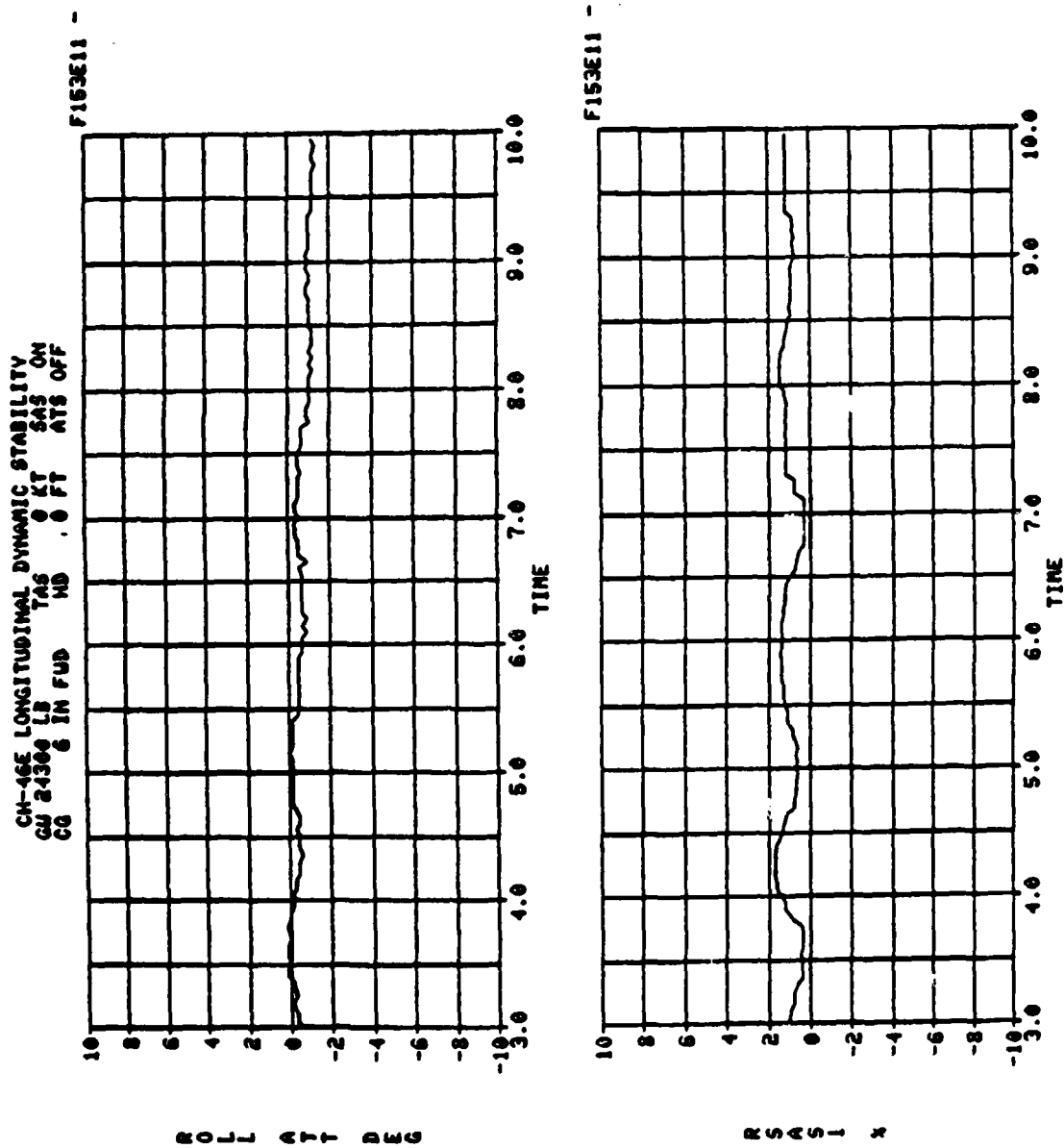


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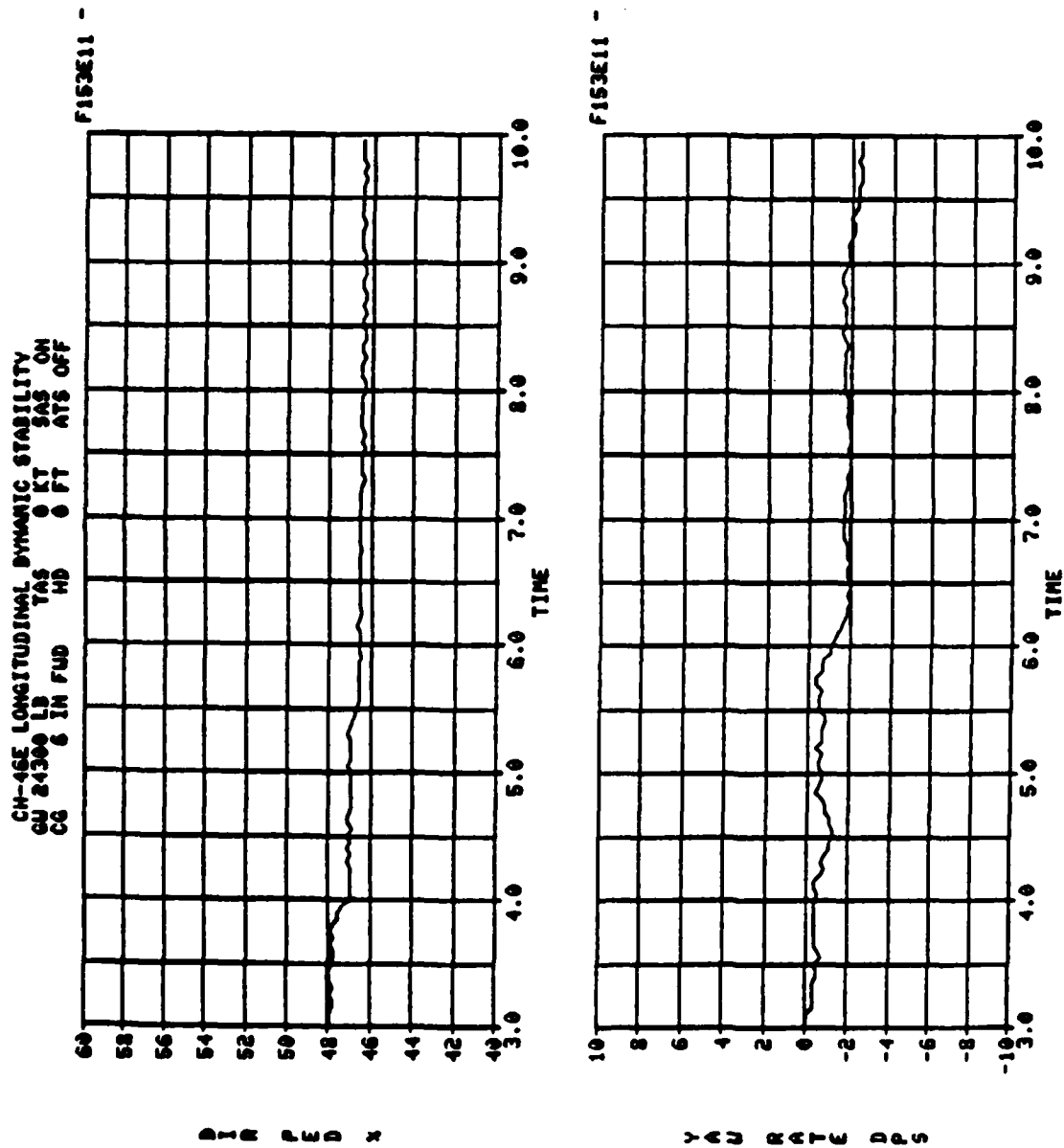


FIGURE 1G

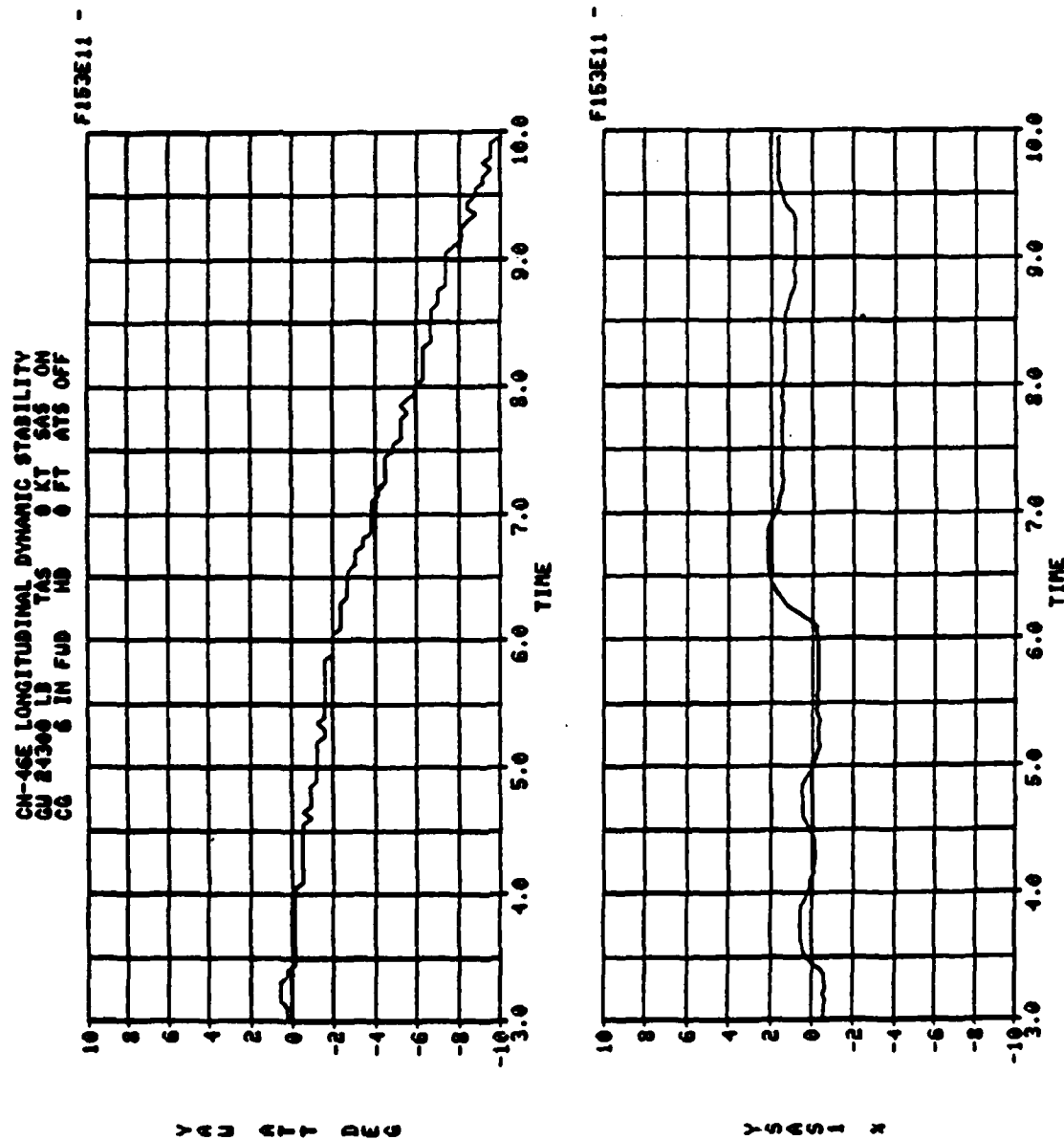


FIGURE 1H



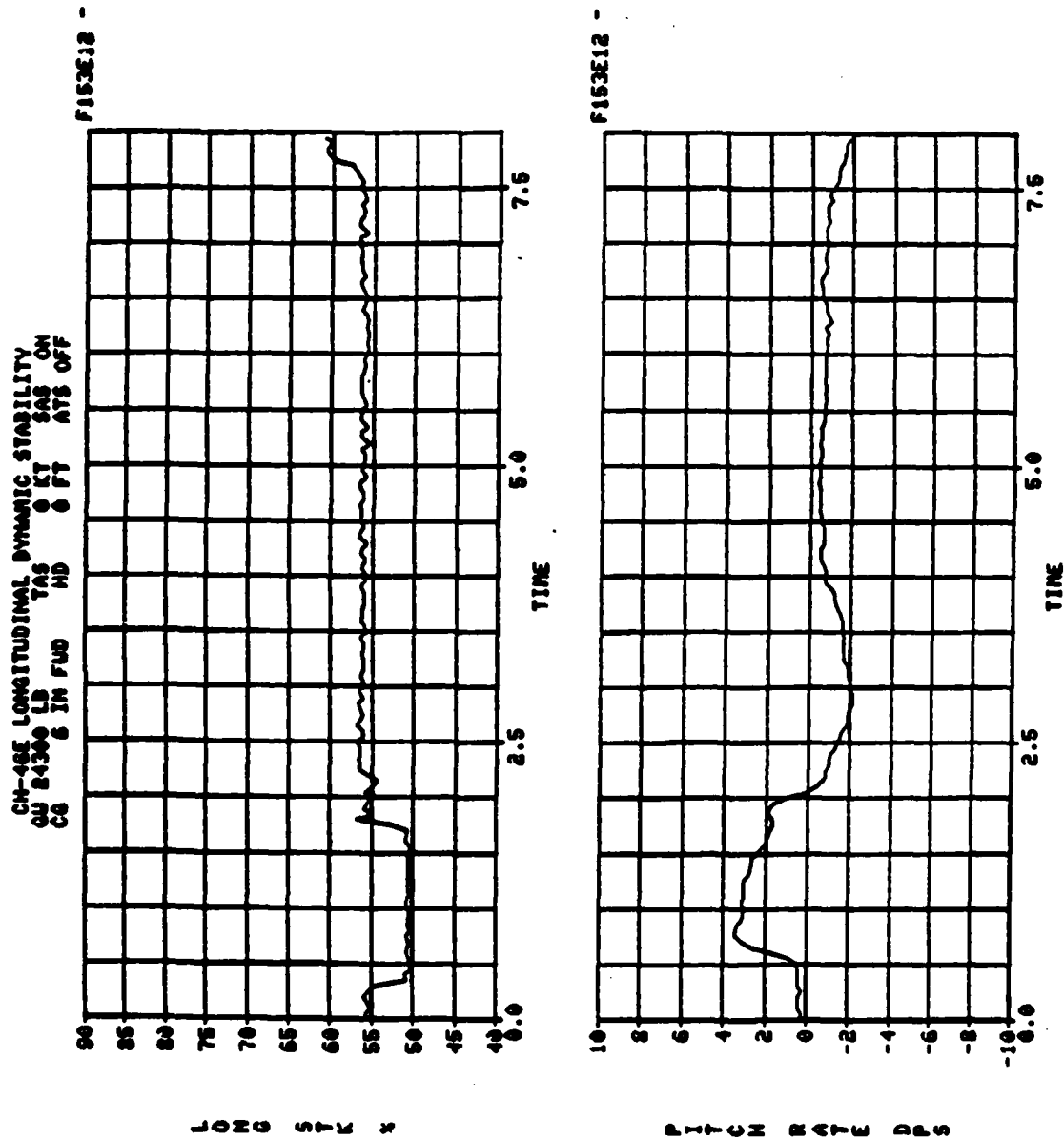


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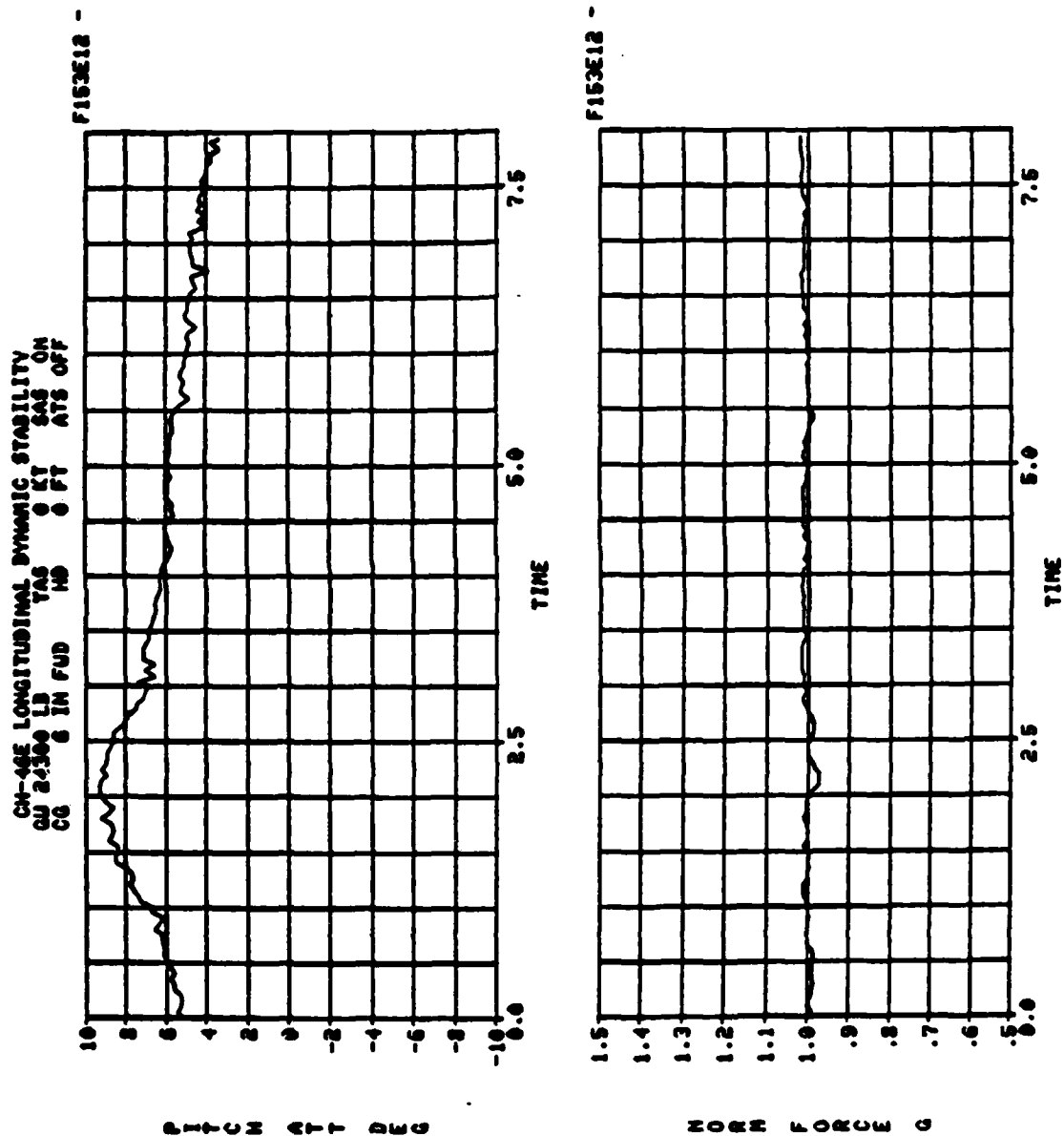


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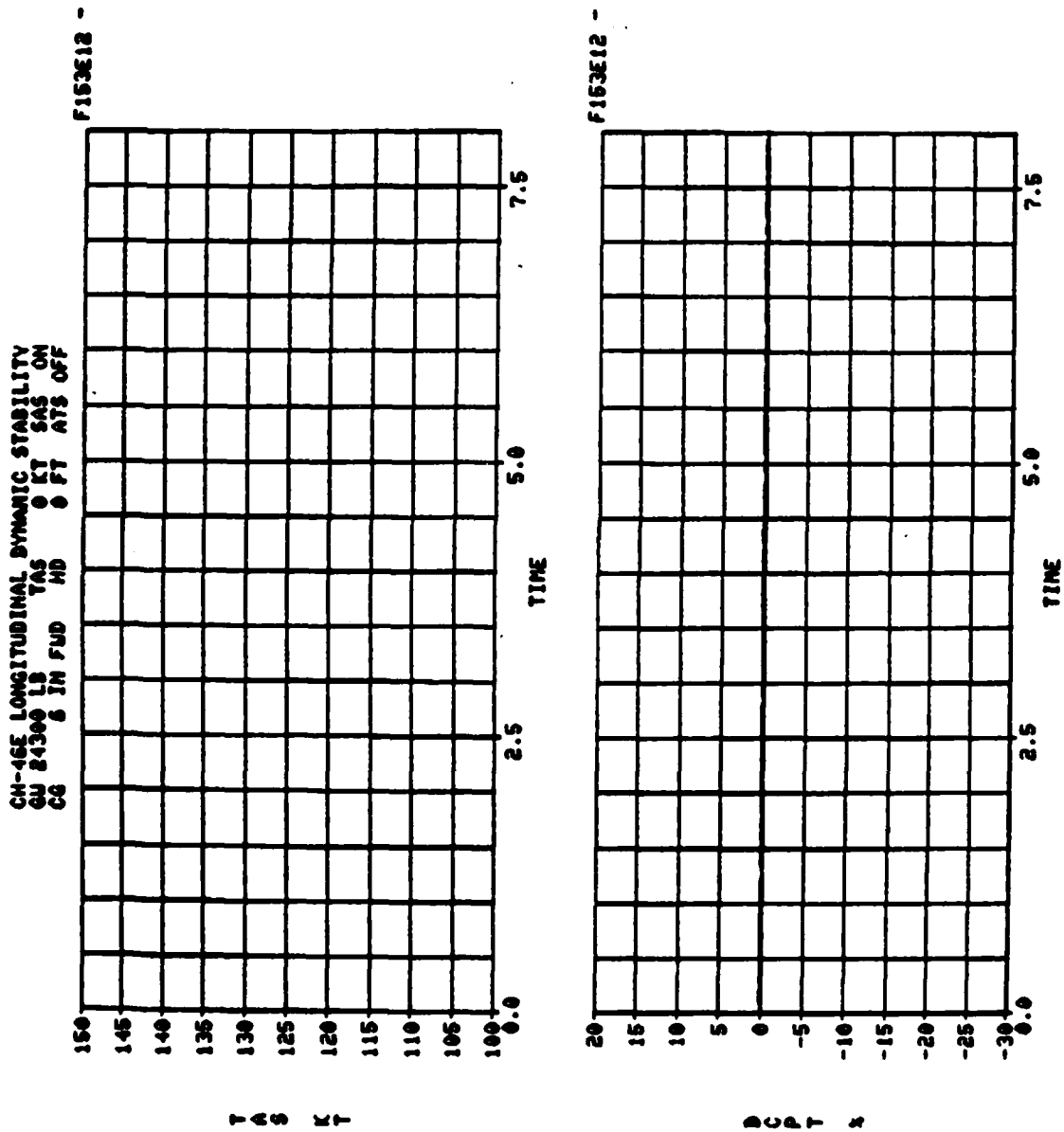


FIGURE 2C

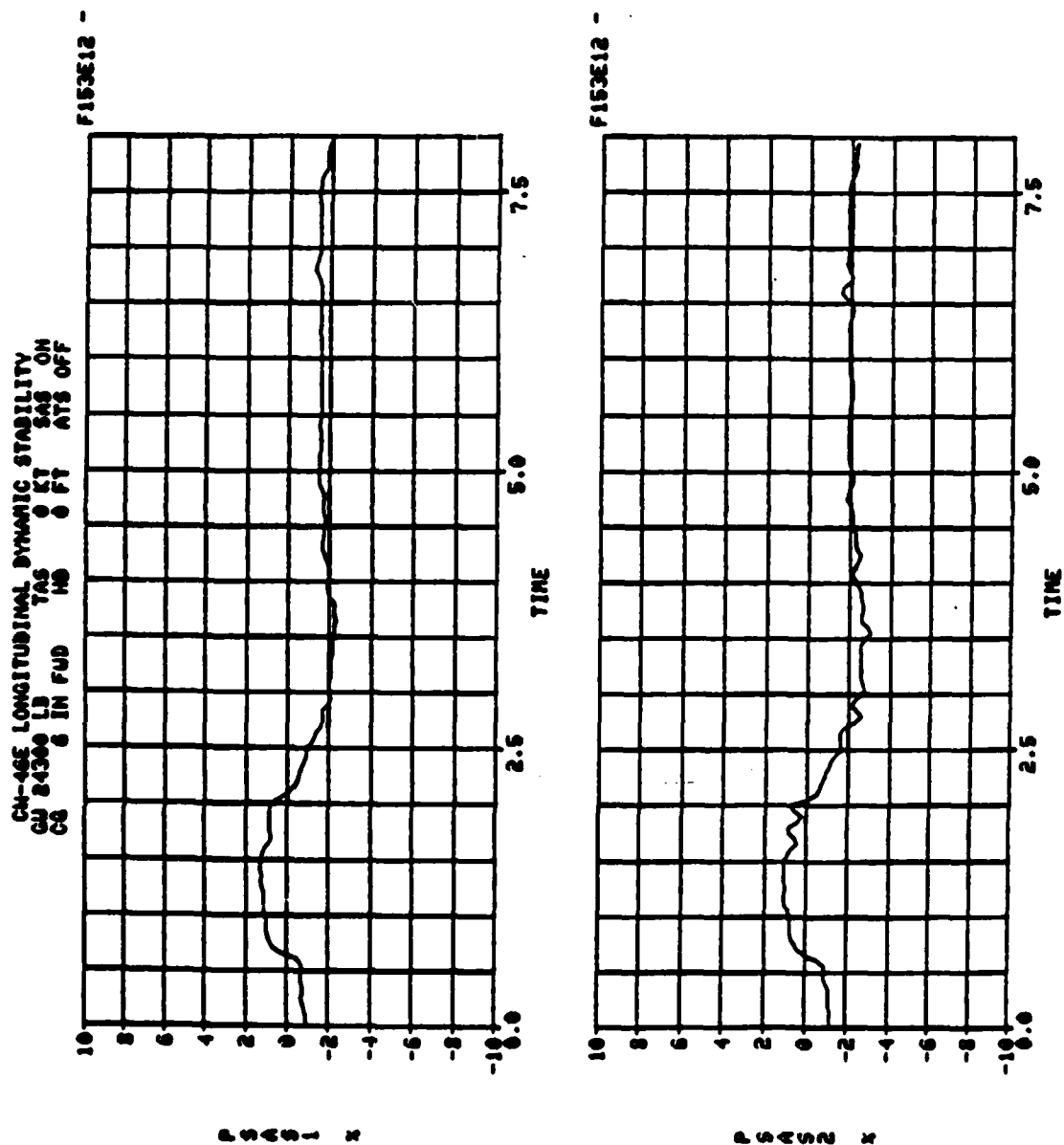


FIGURE 20

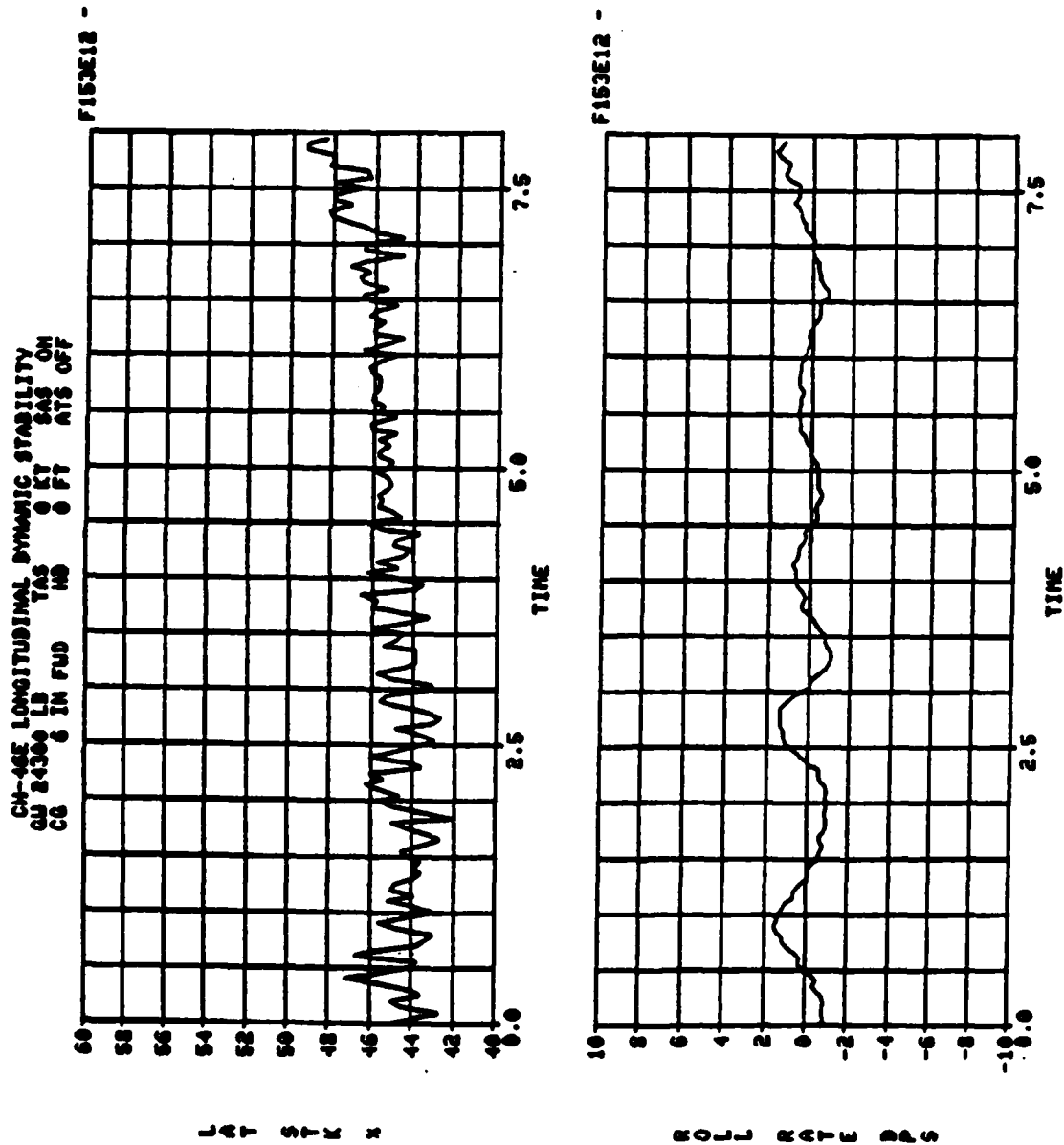


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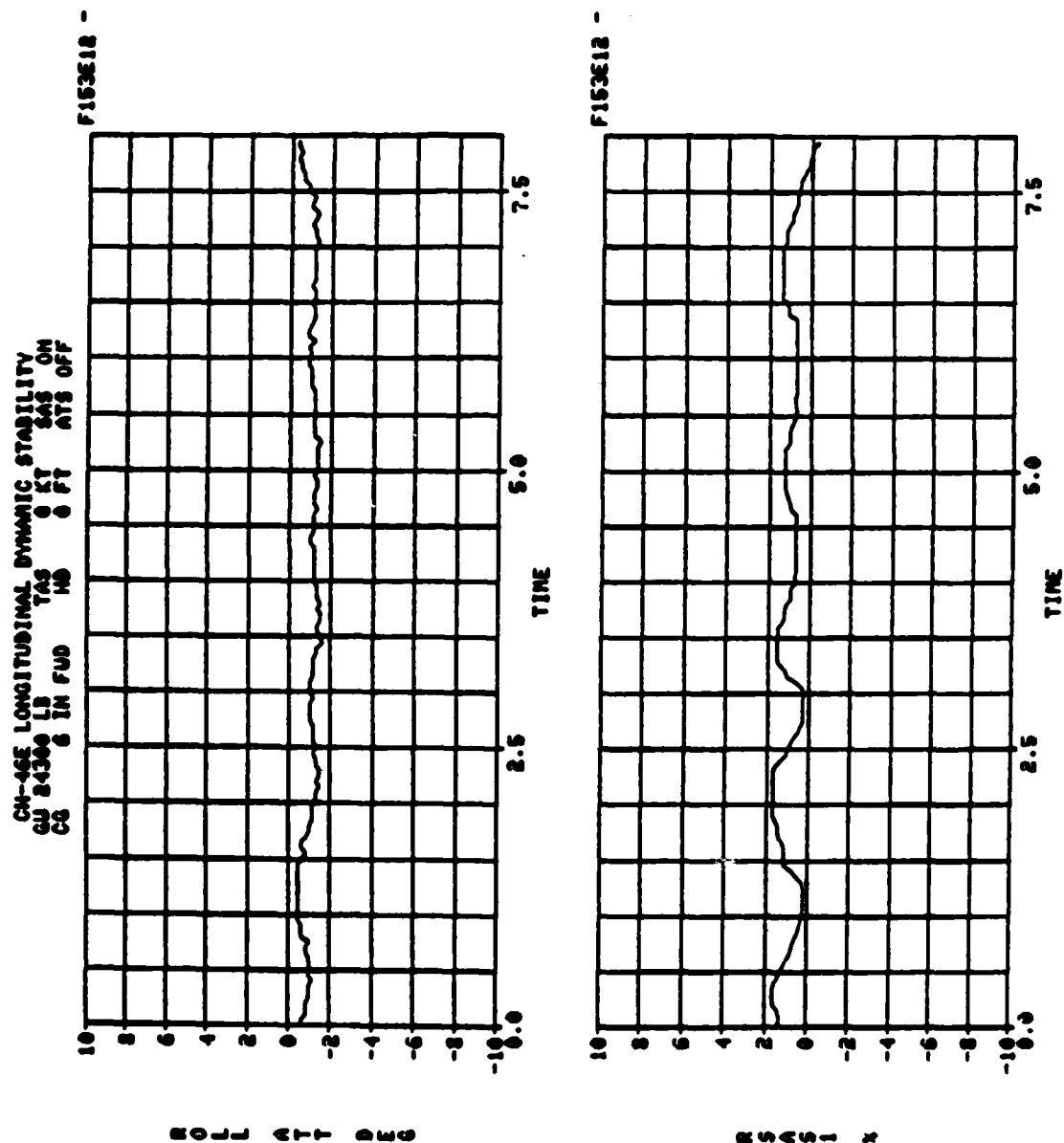


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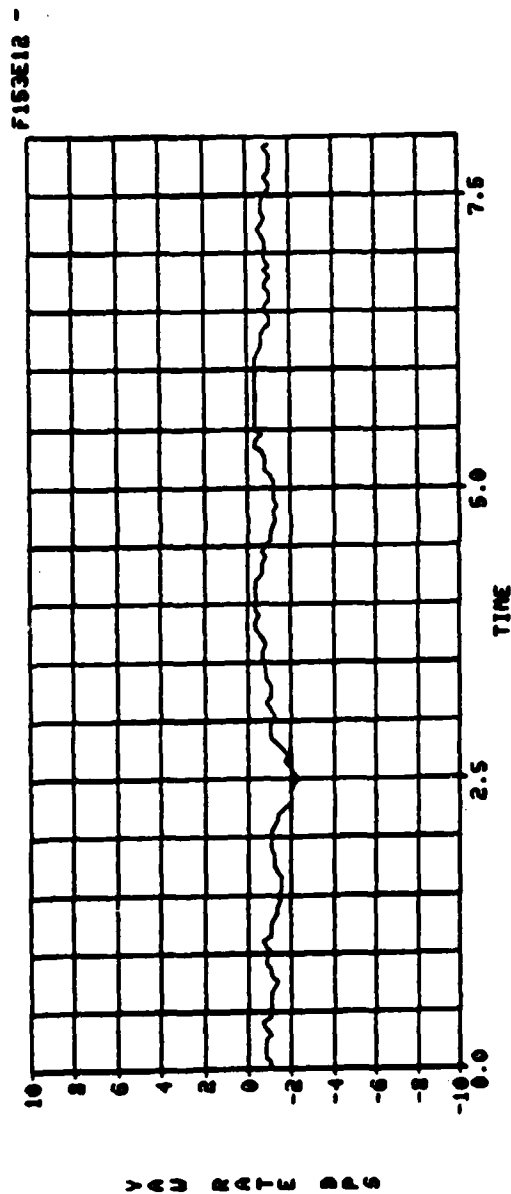
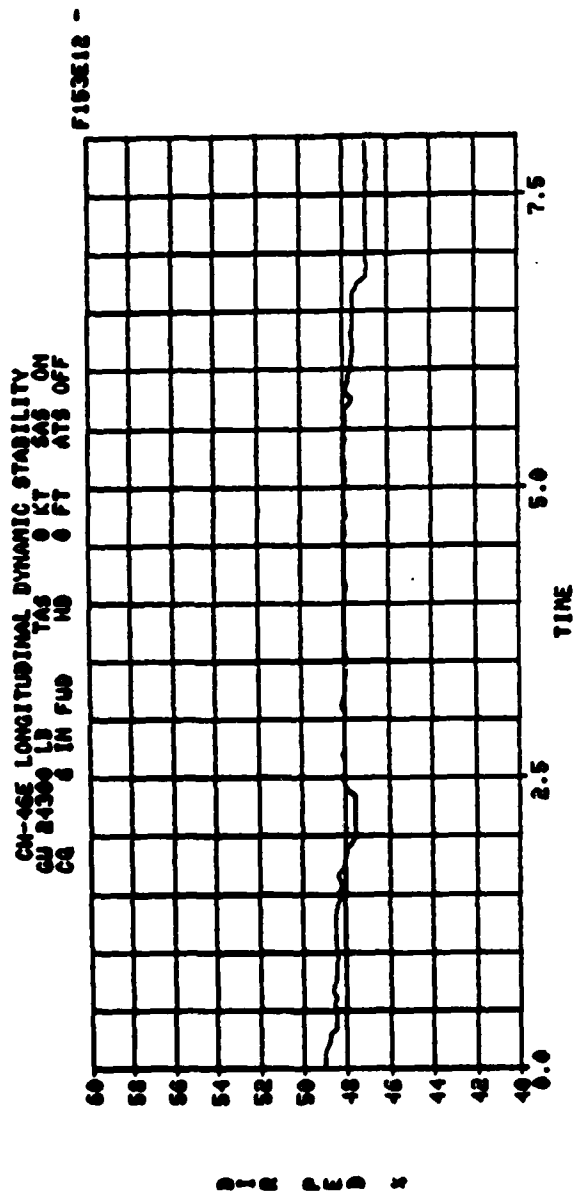


FIGURE 2G

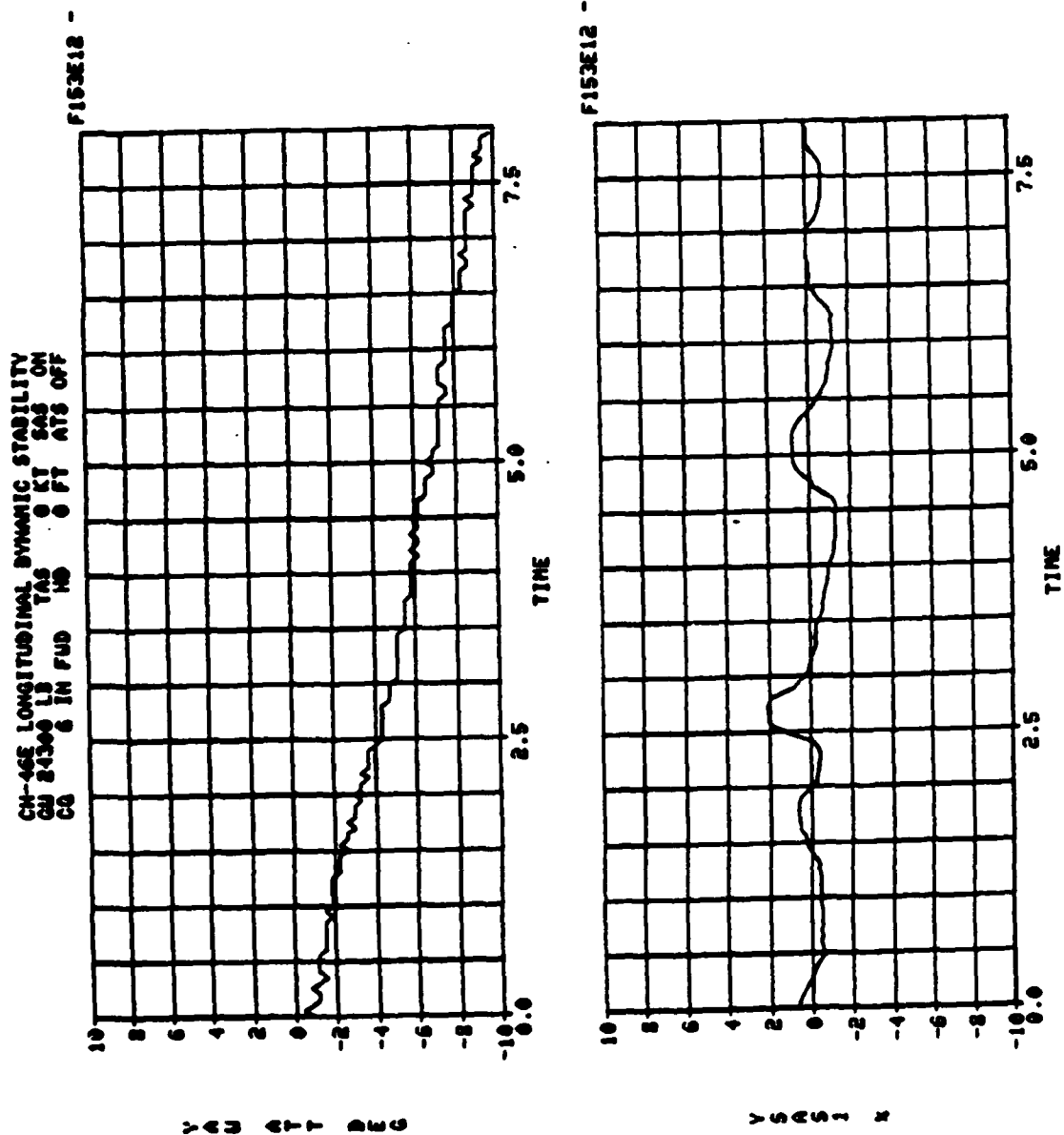


FIGURE 2H



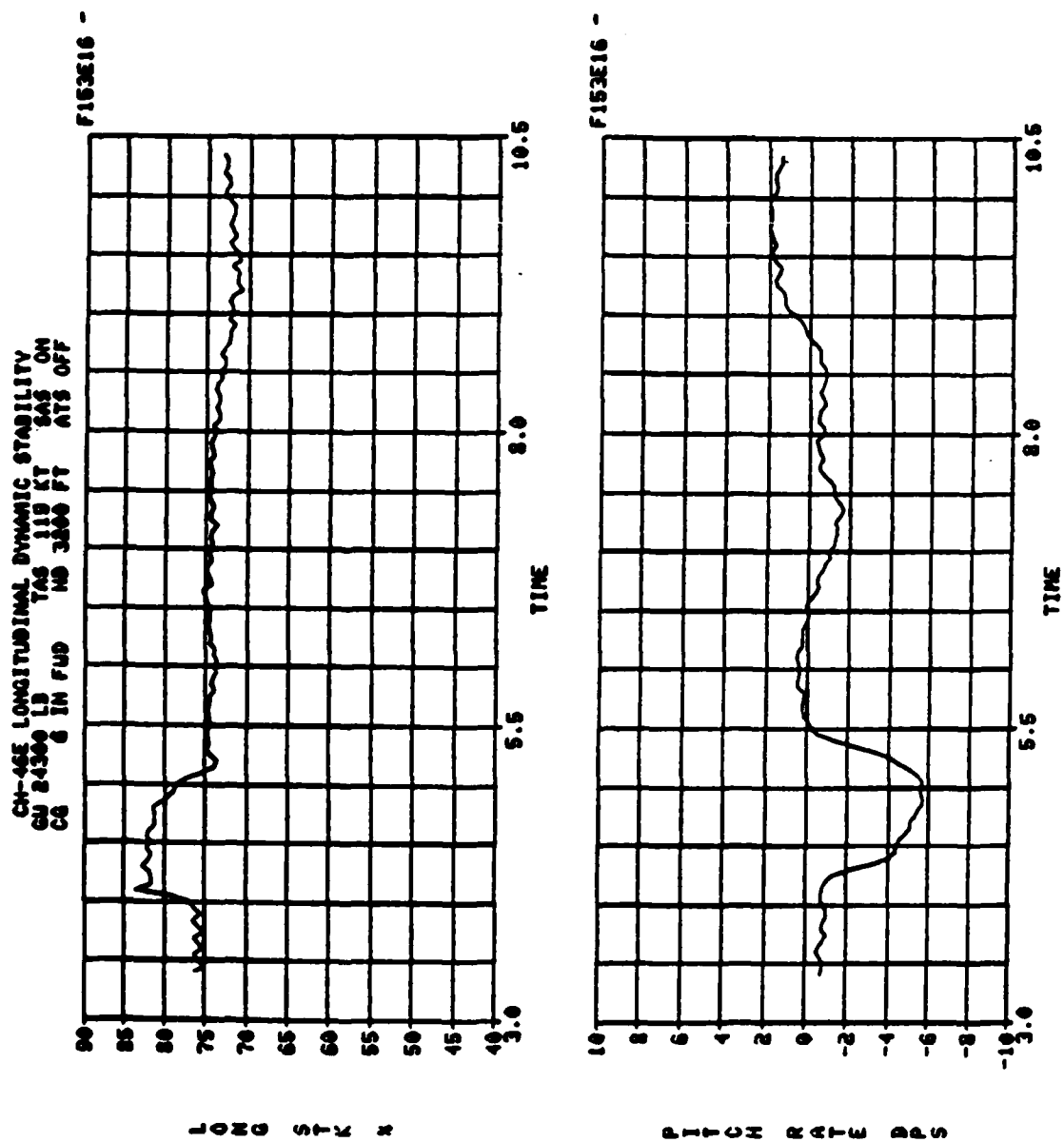


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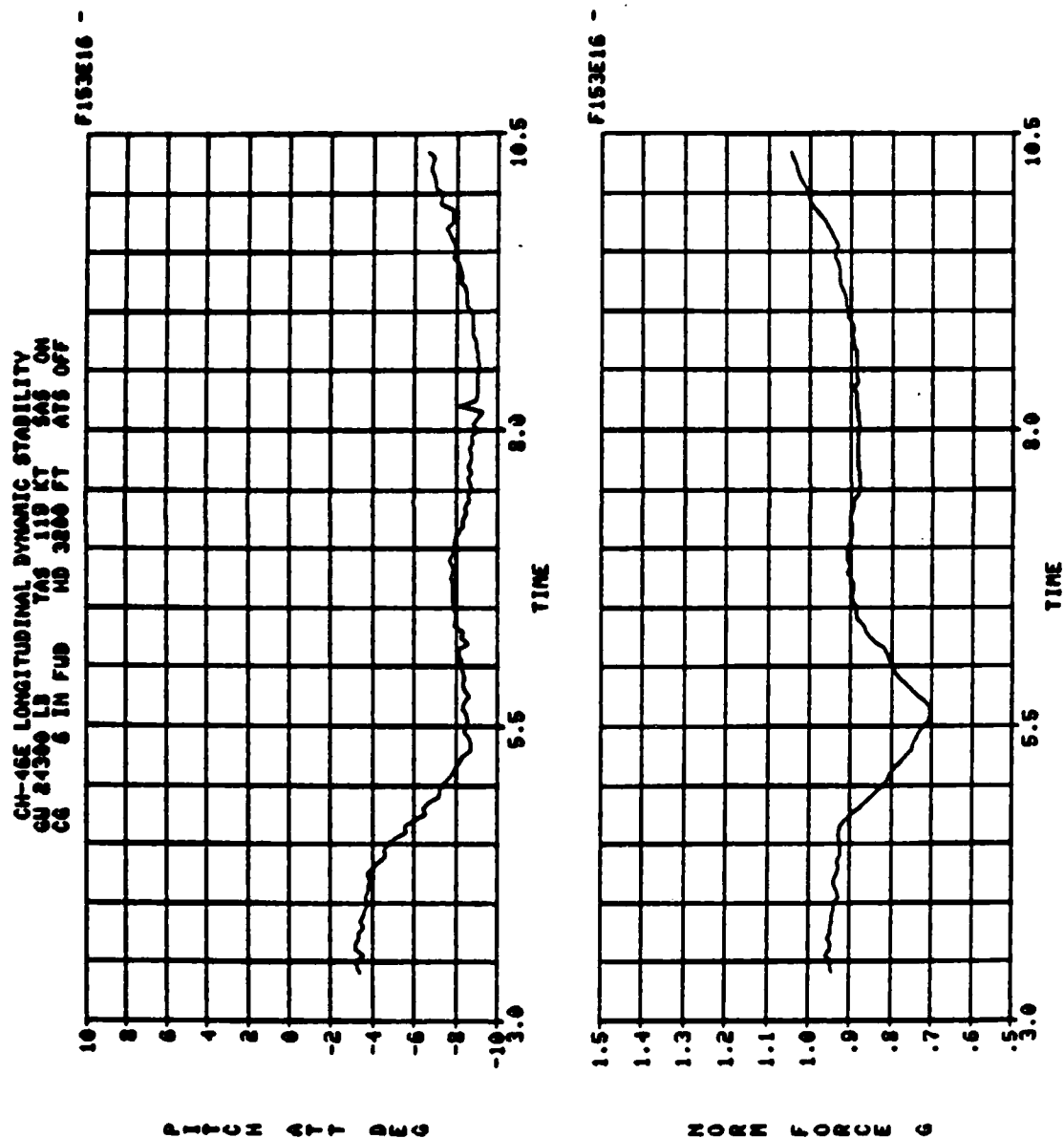


FIGURE 38

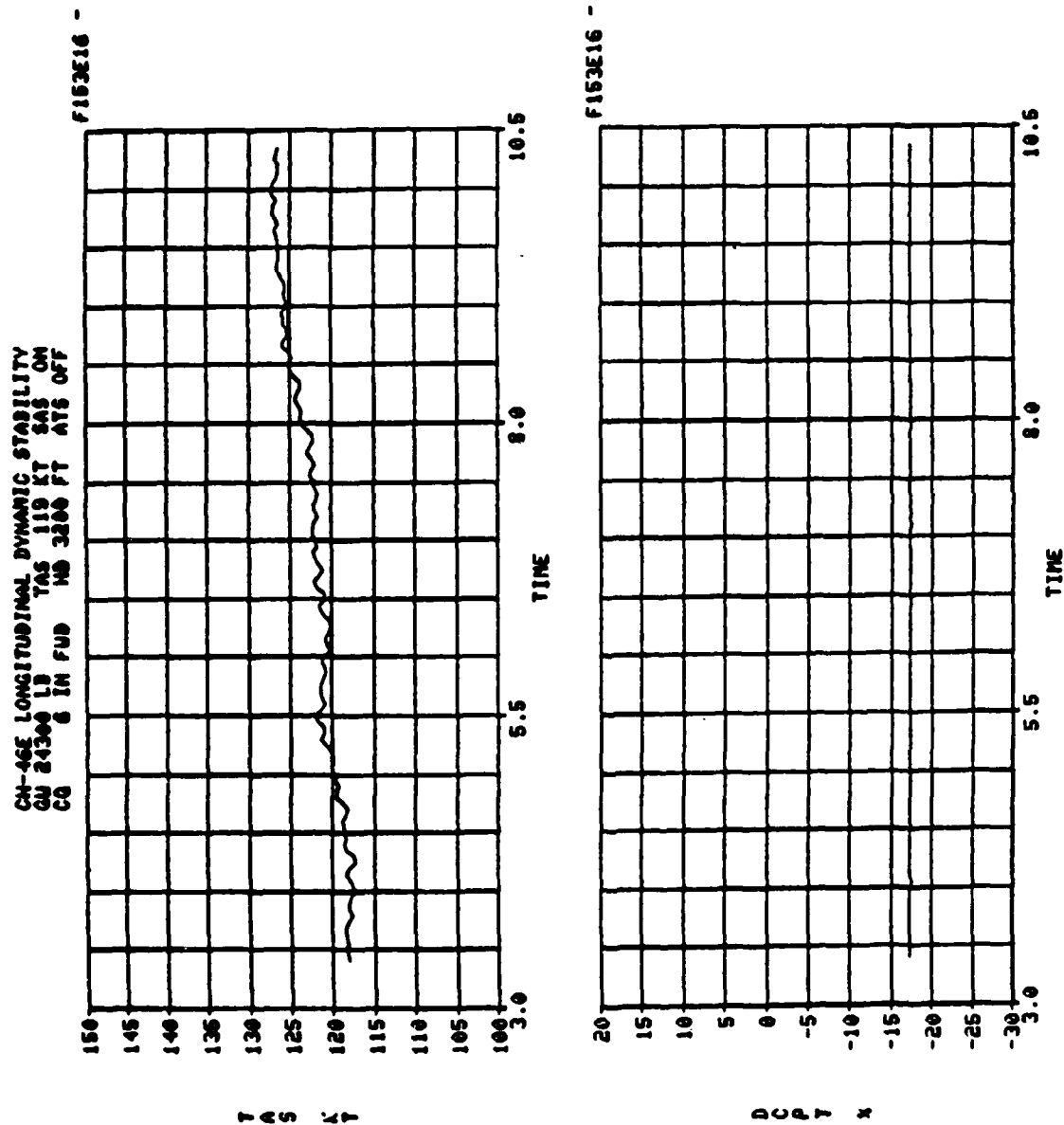


FIGURE 3C

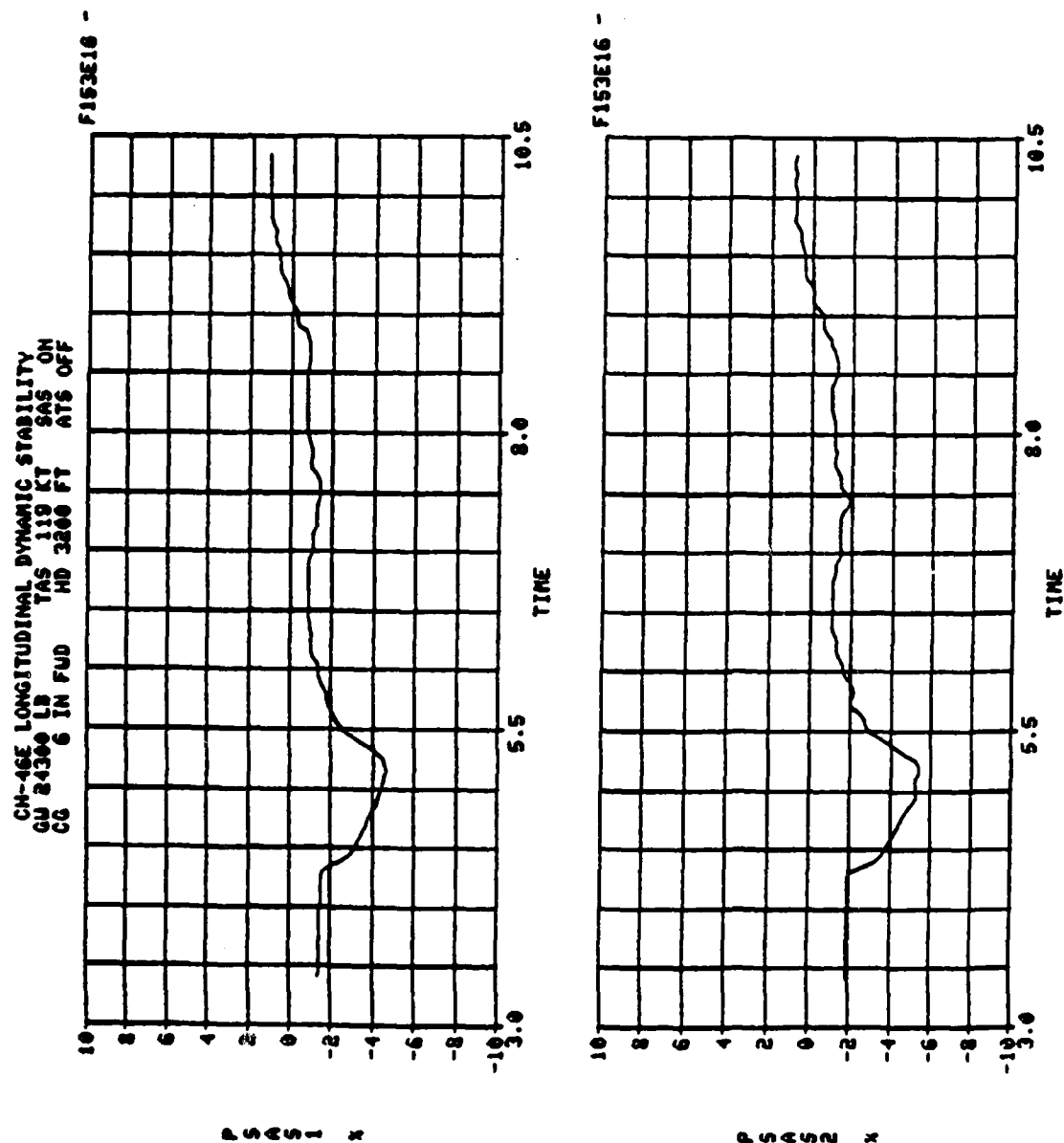


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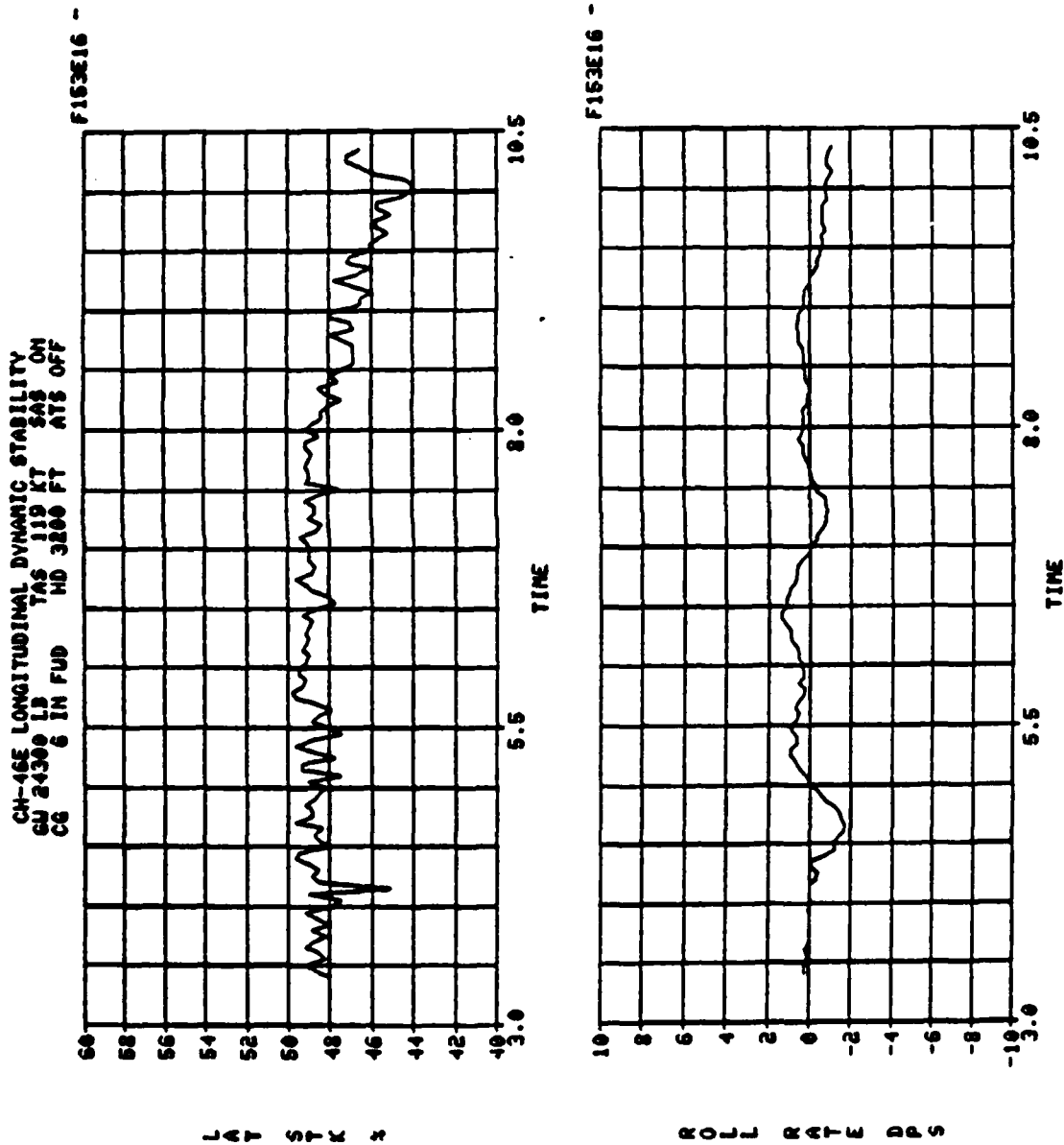


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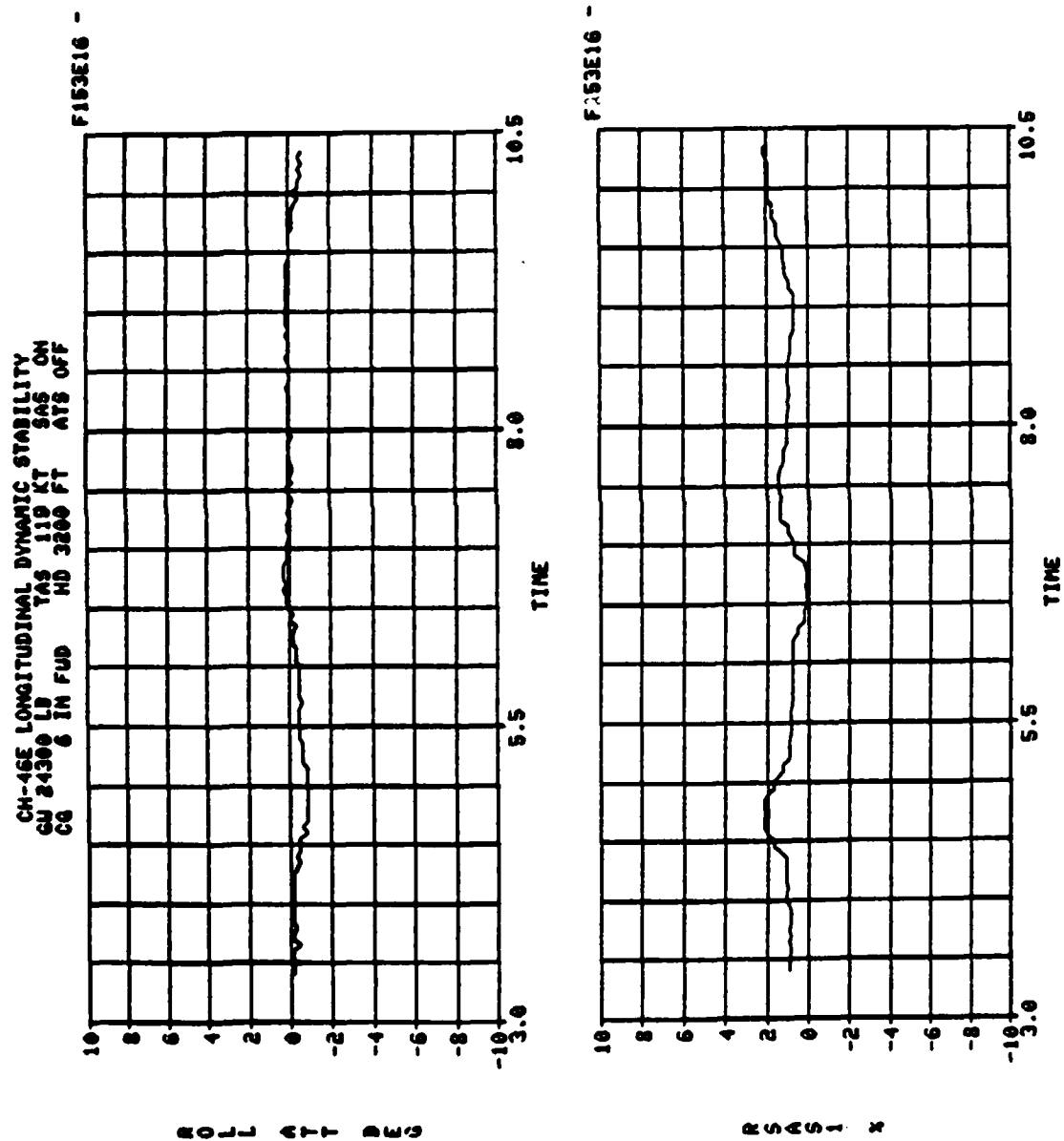


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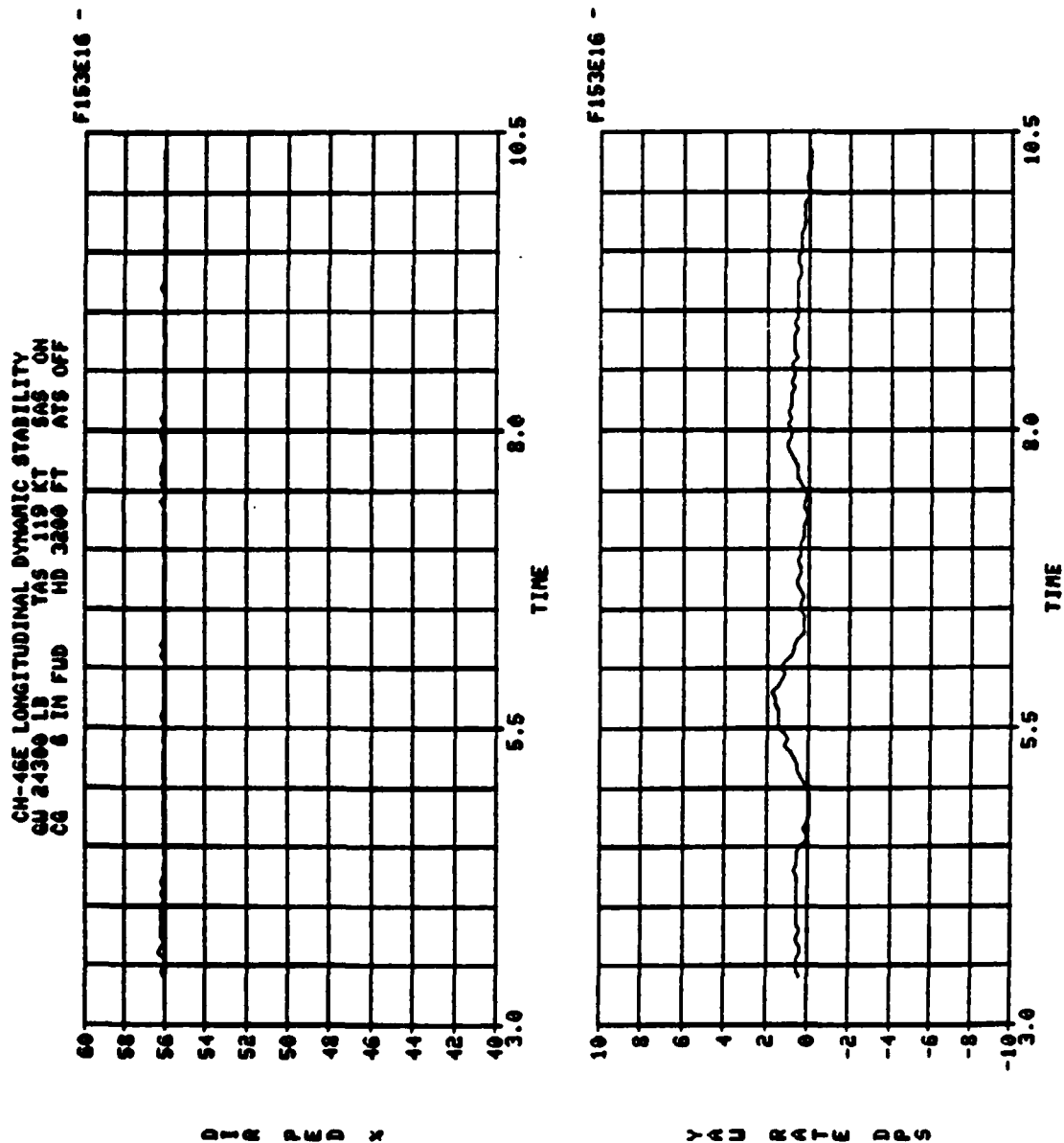


FIGURE 3G

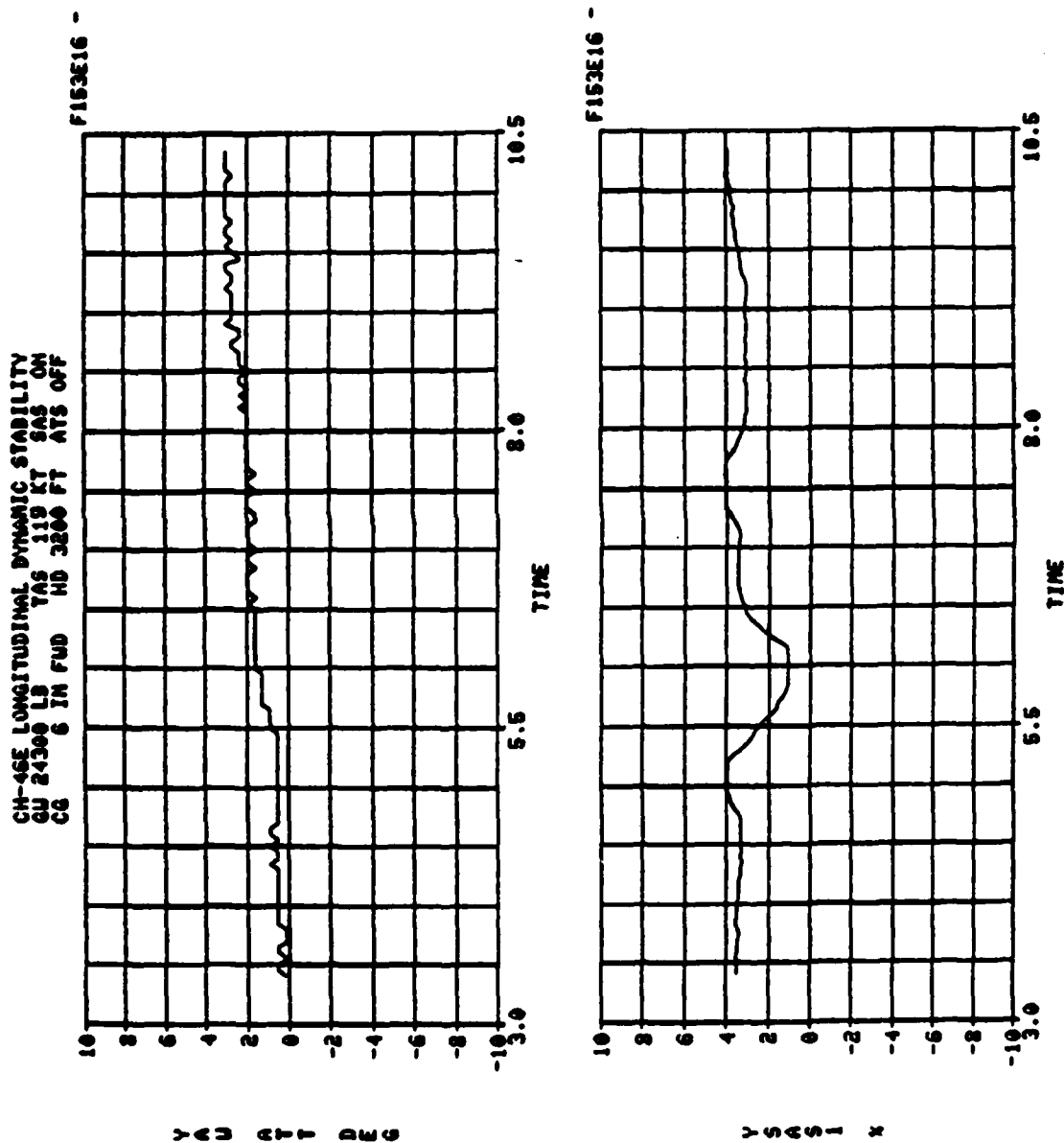


FIGURE 3H



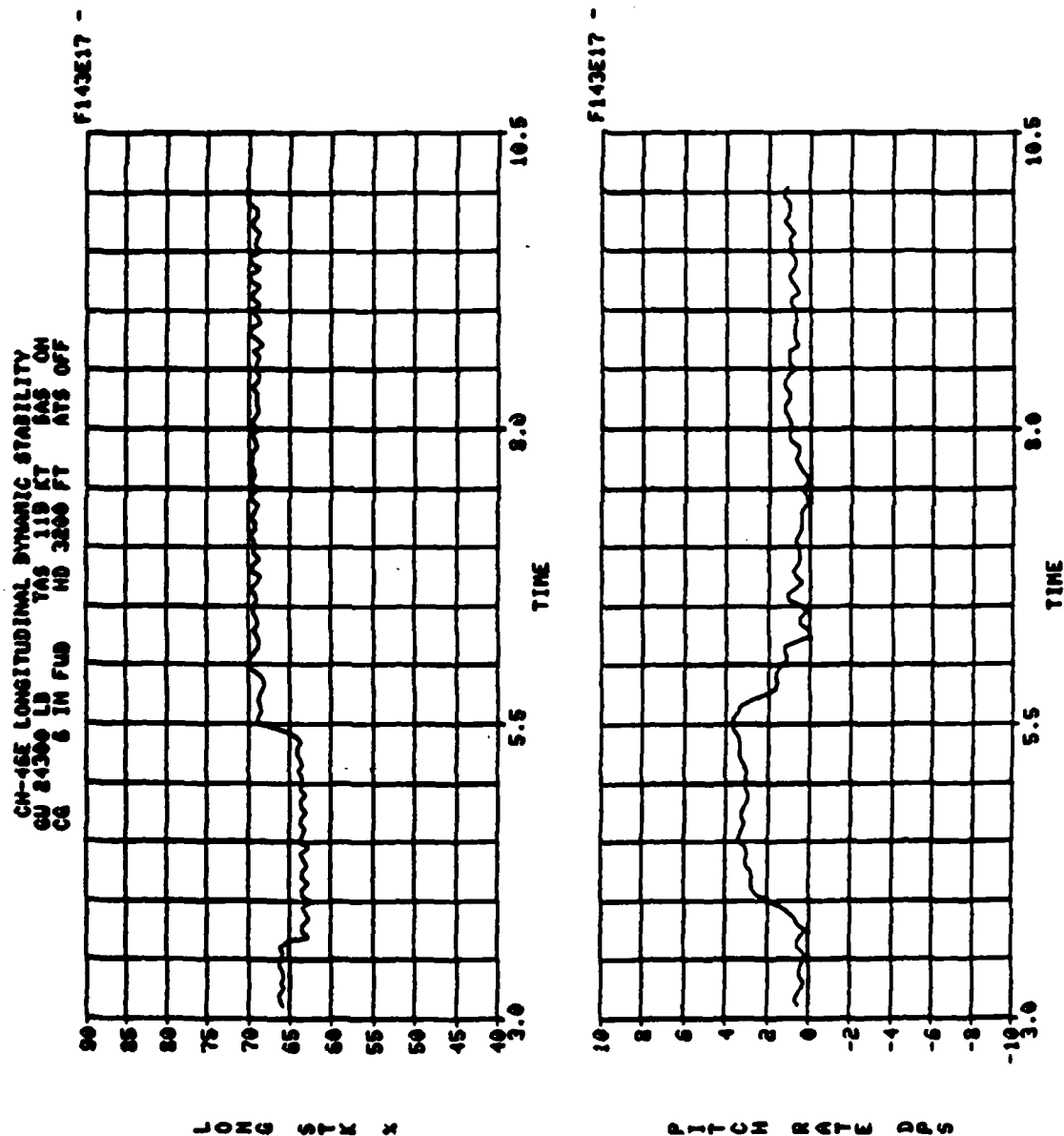


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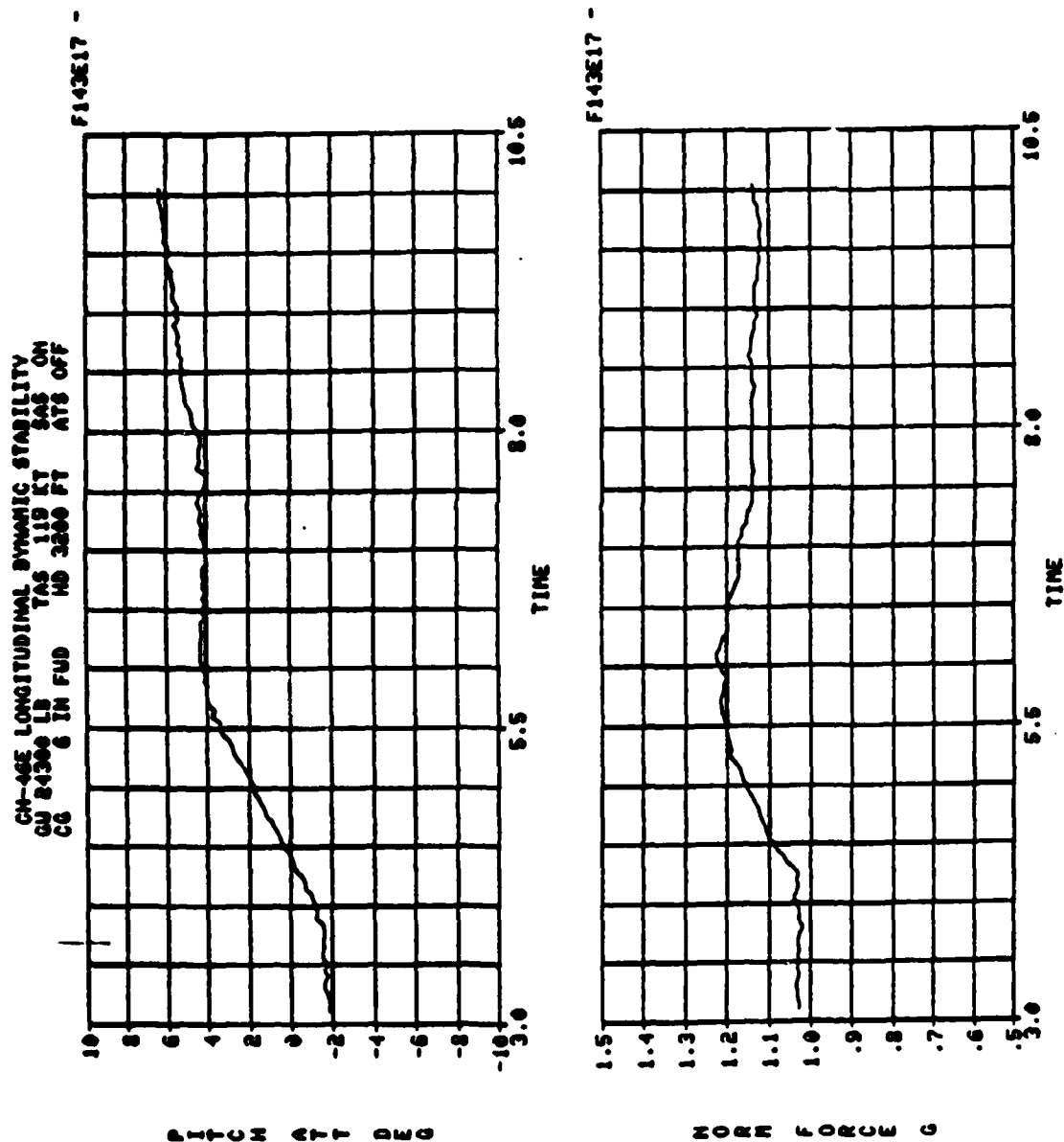


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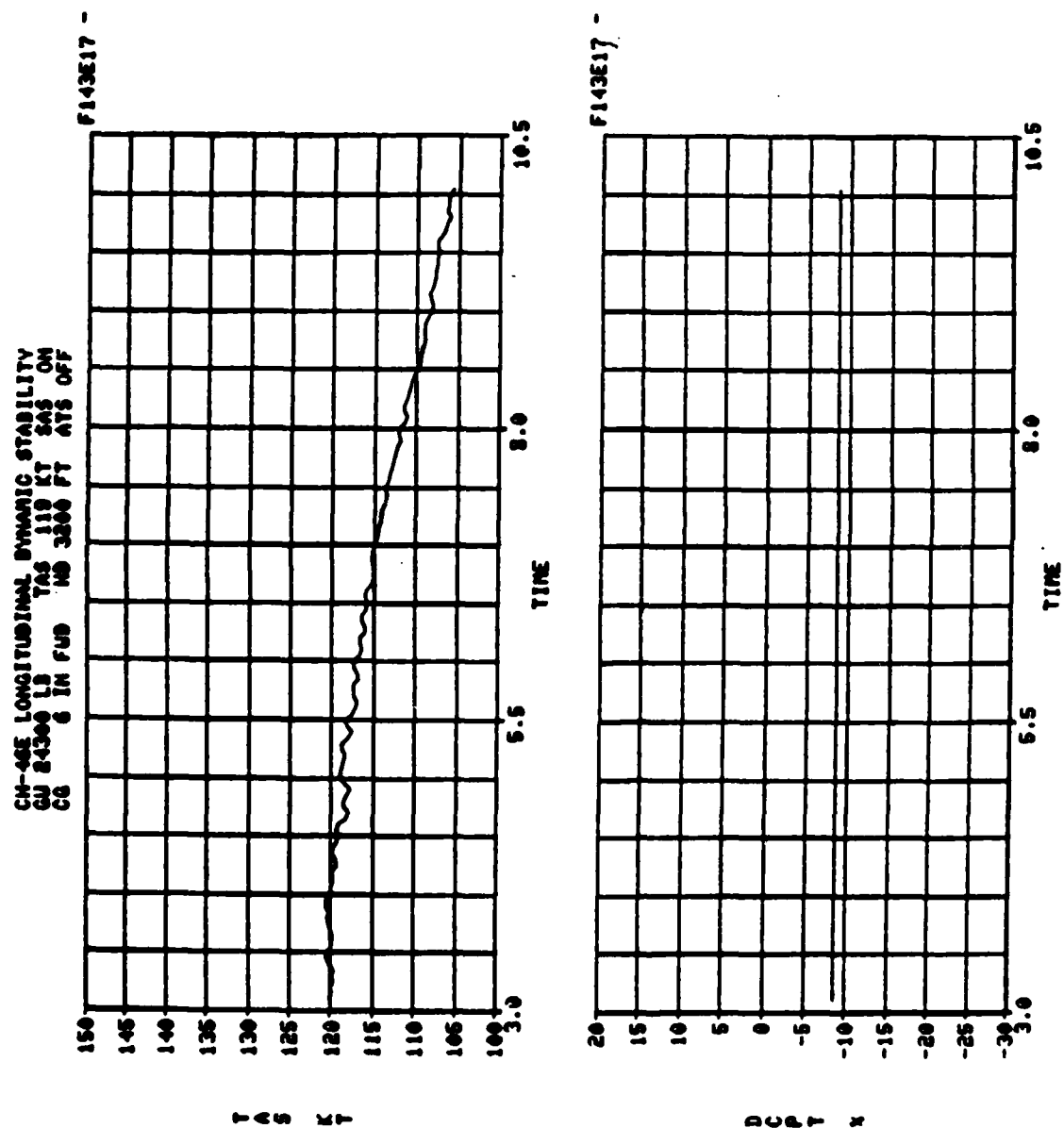


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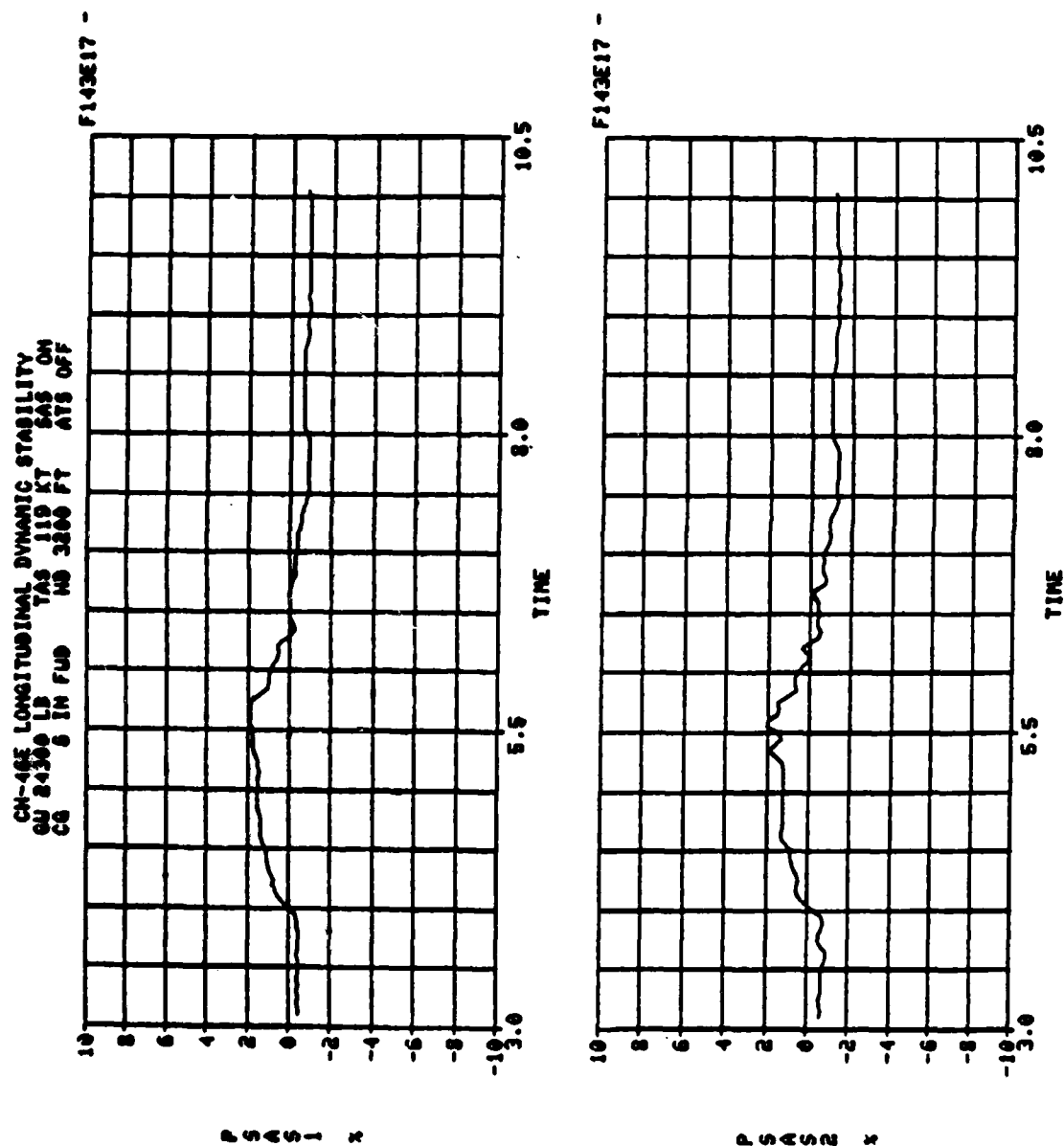


FIGURE 4D

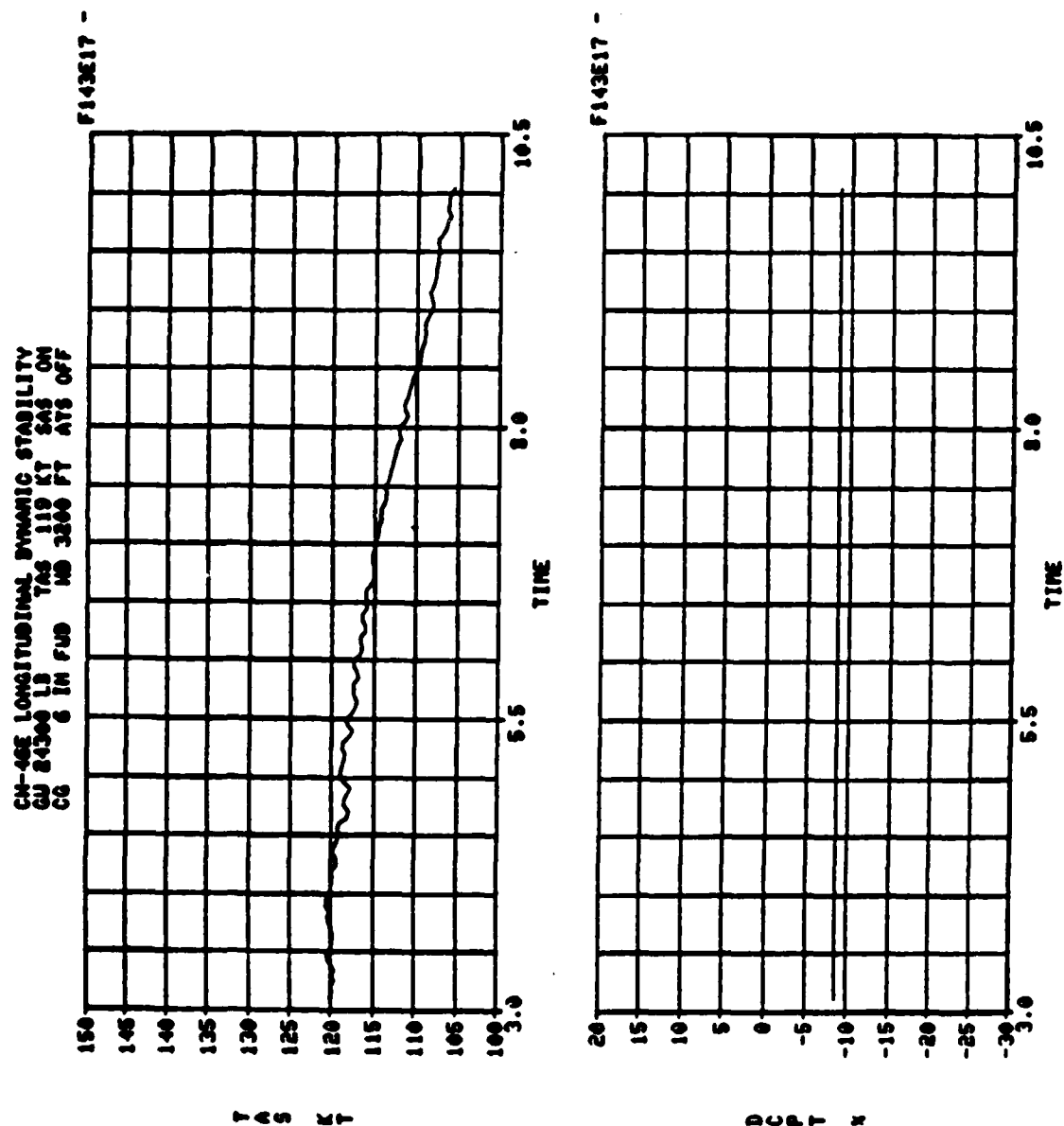


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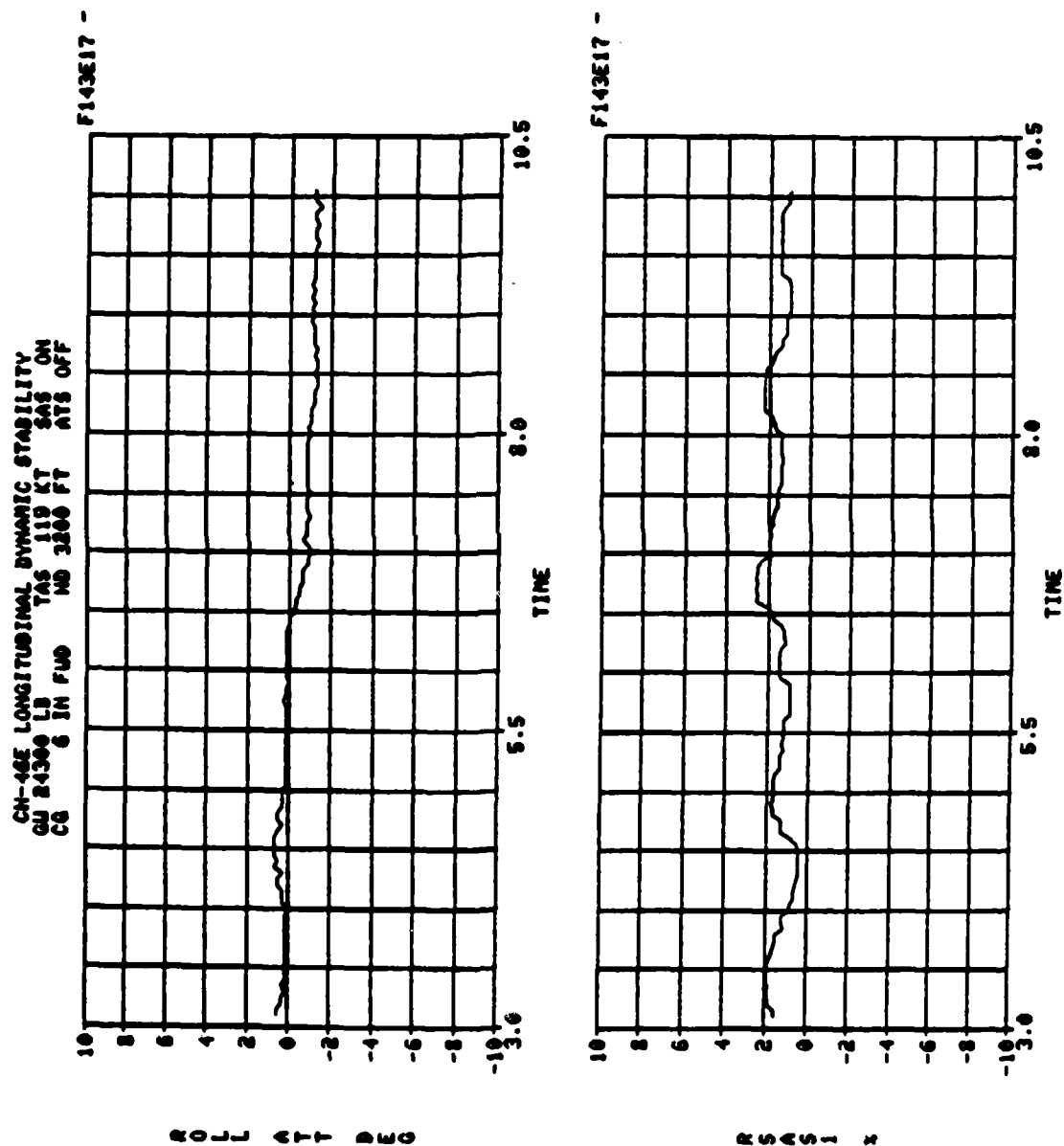


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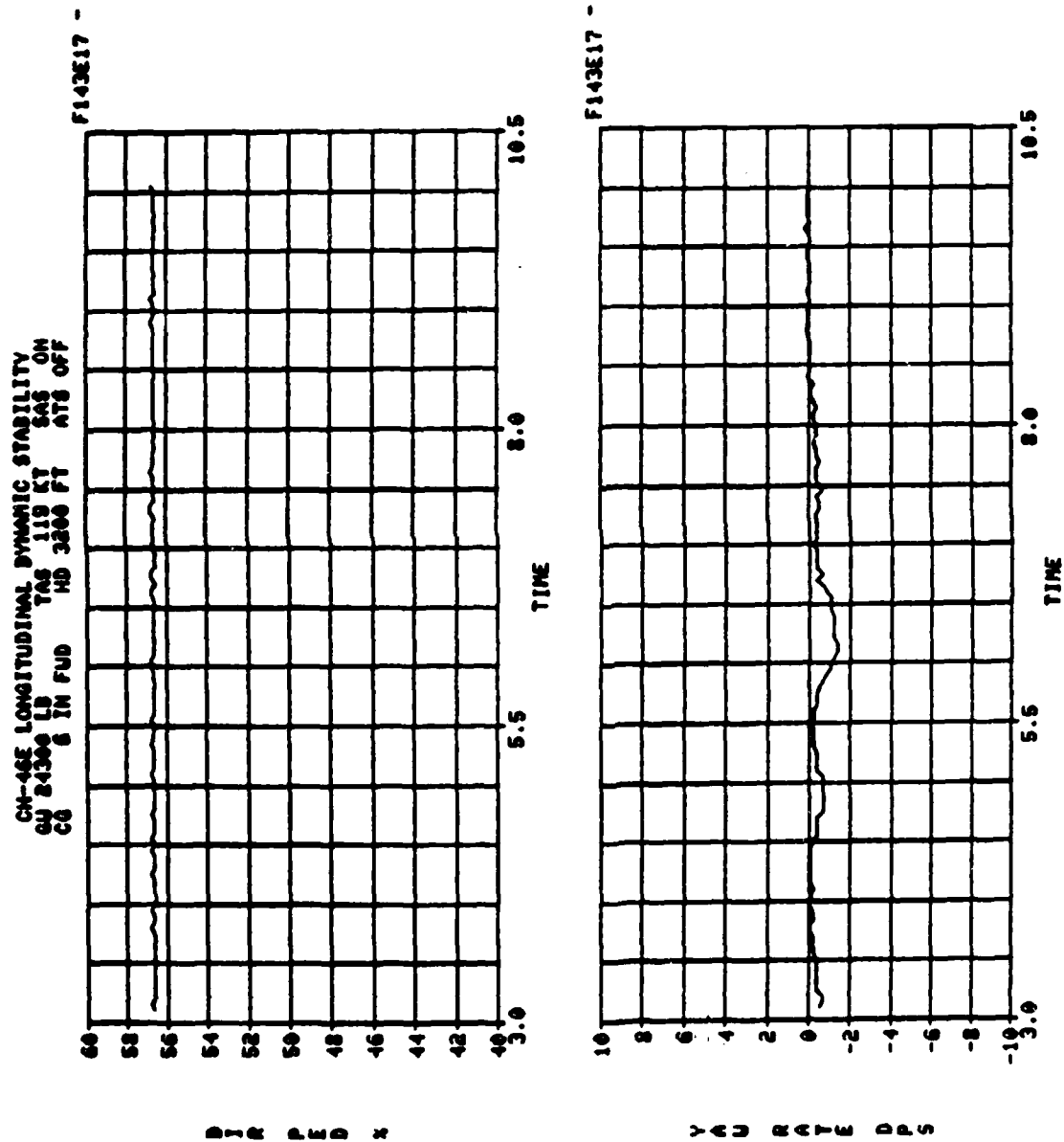


FIGURE 4G

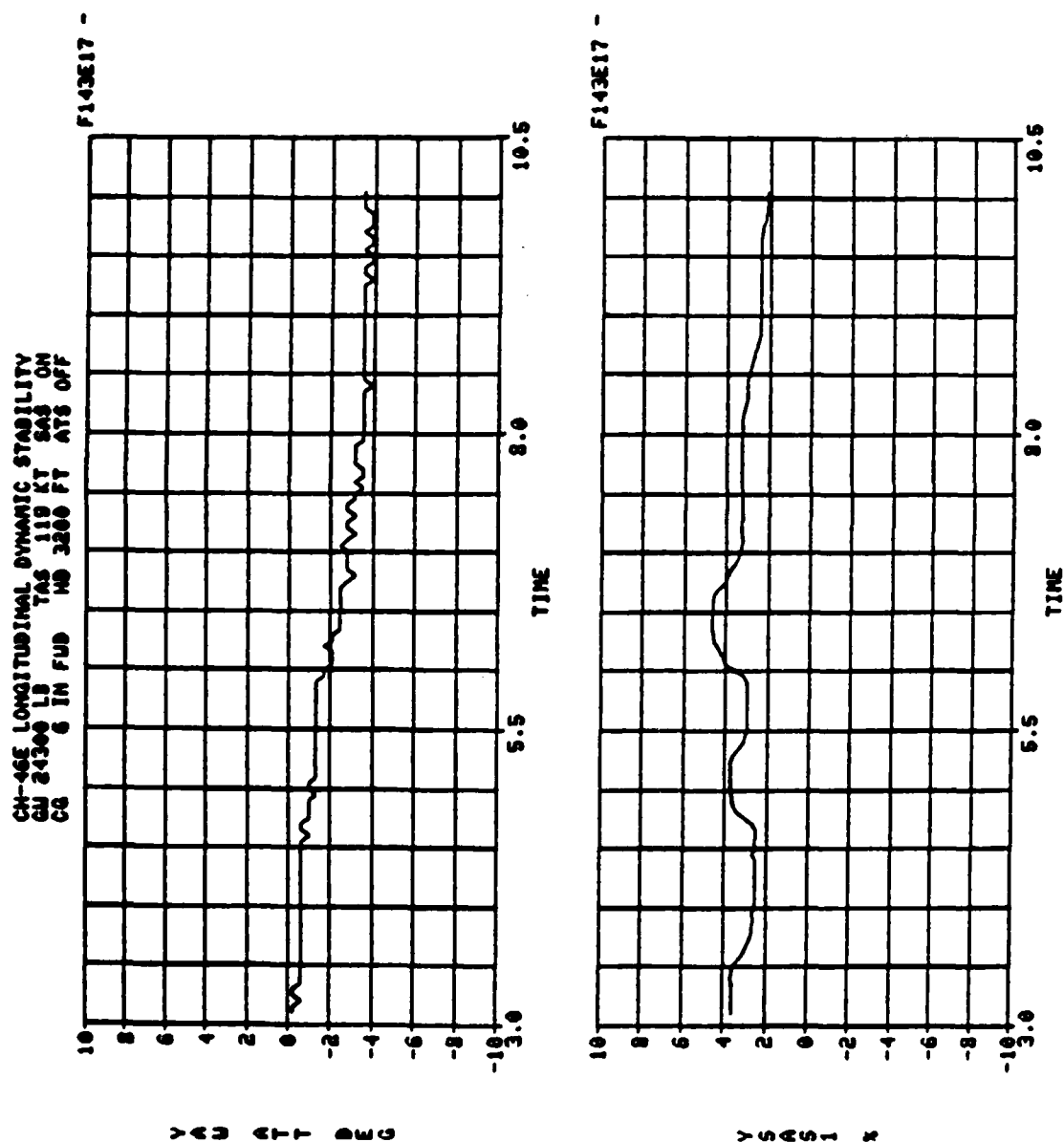


FIGURE 4H



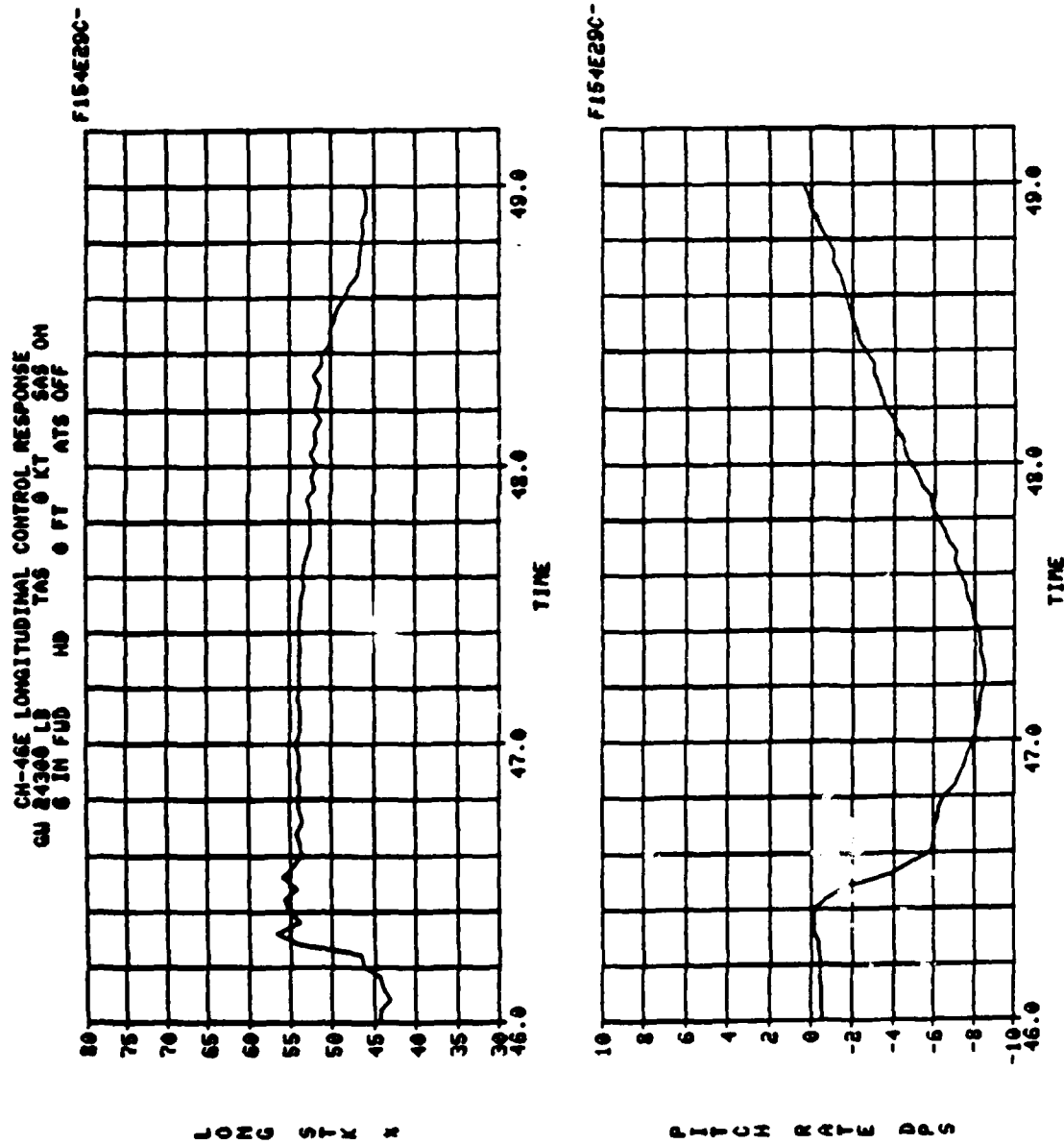


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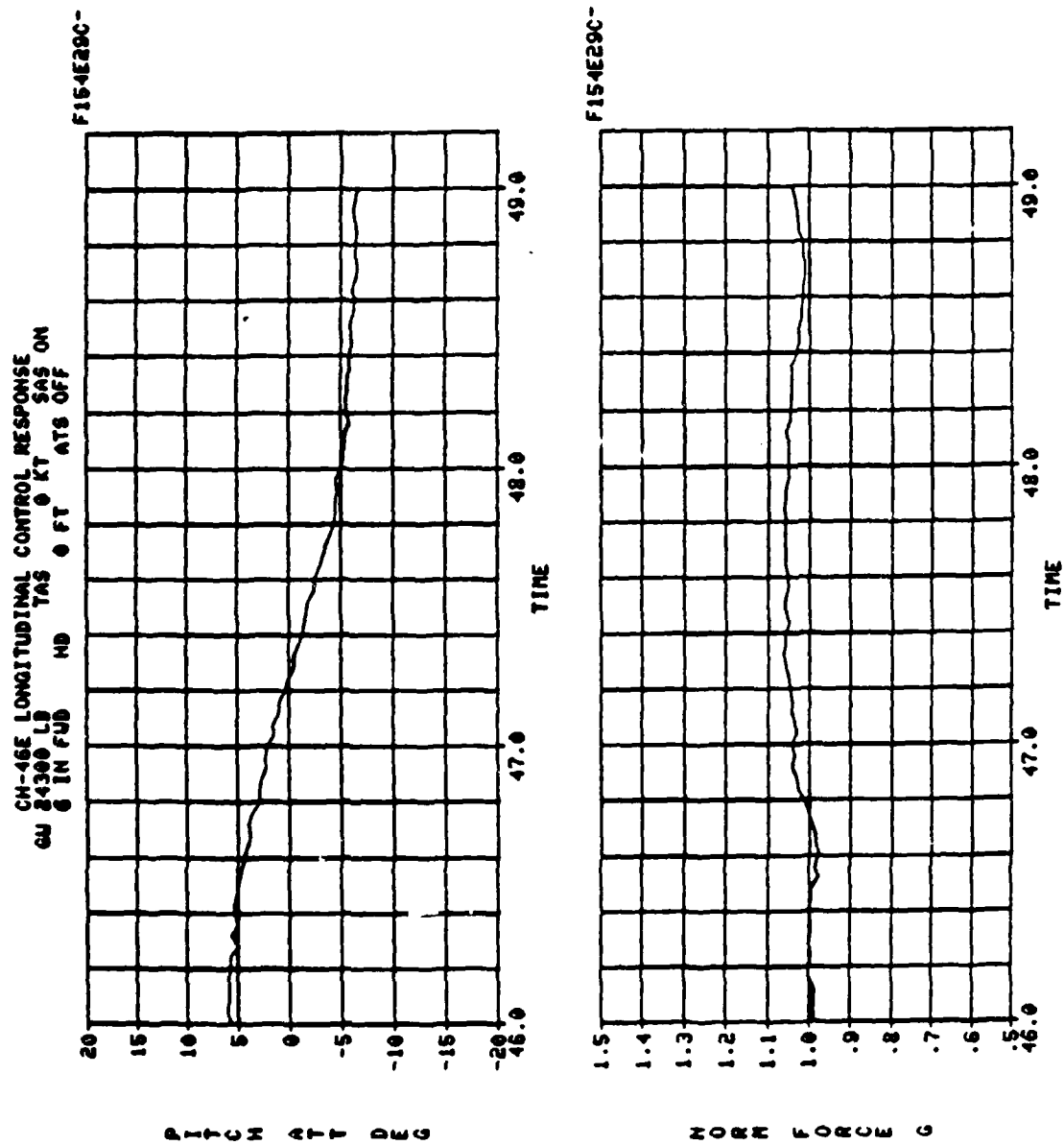


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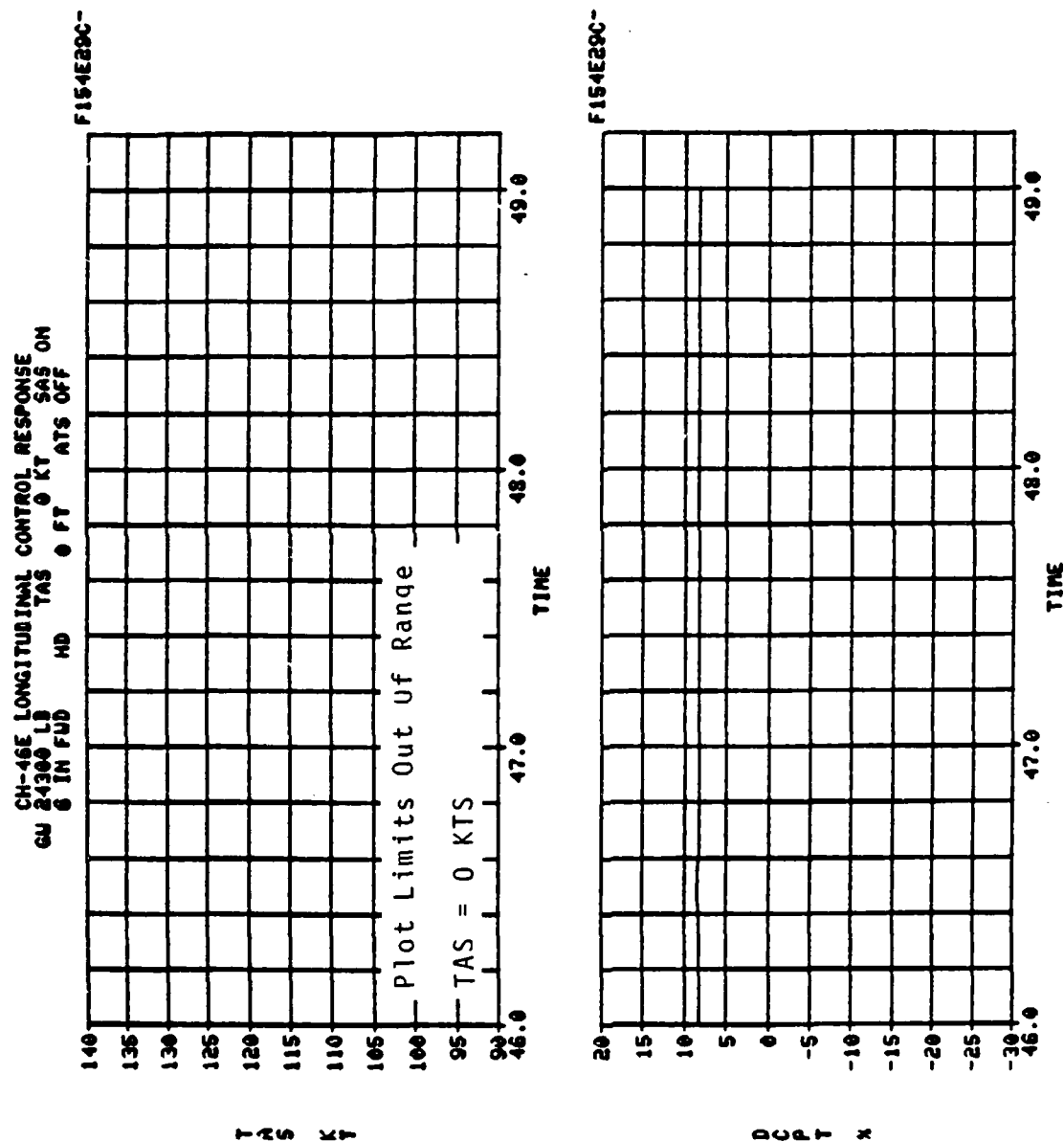


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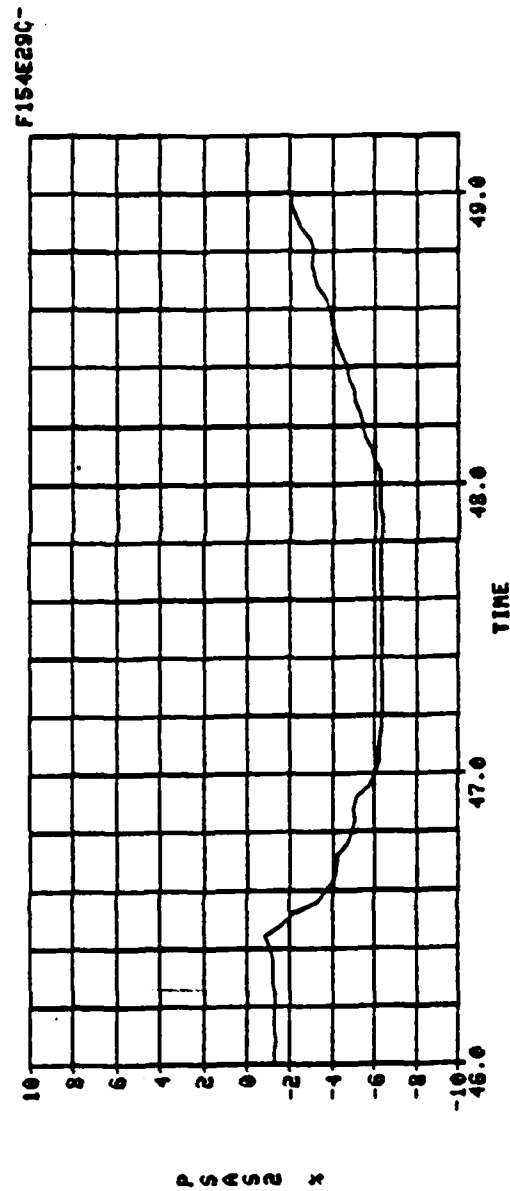
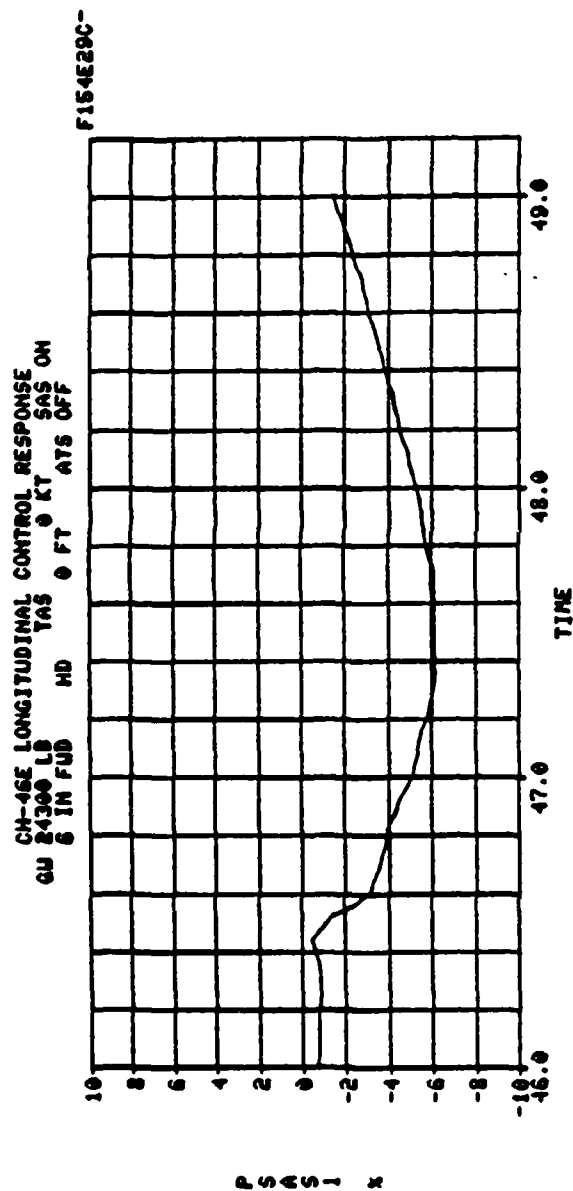


FIGURE 5D

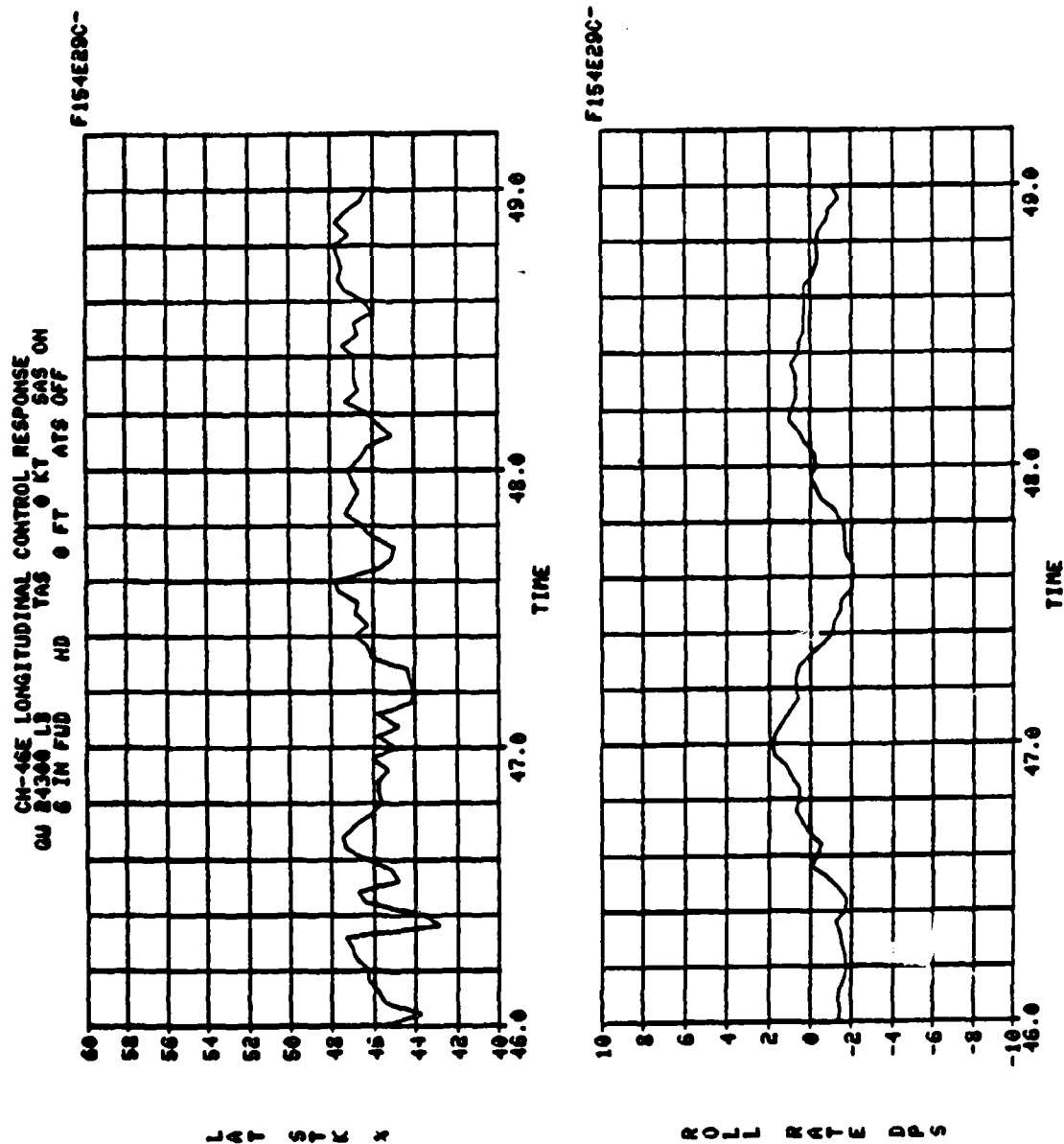


FIGURE 5E

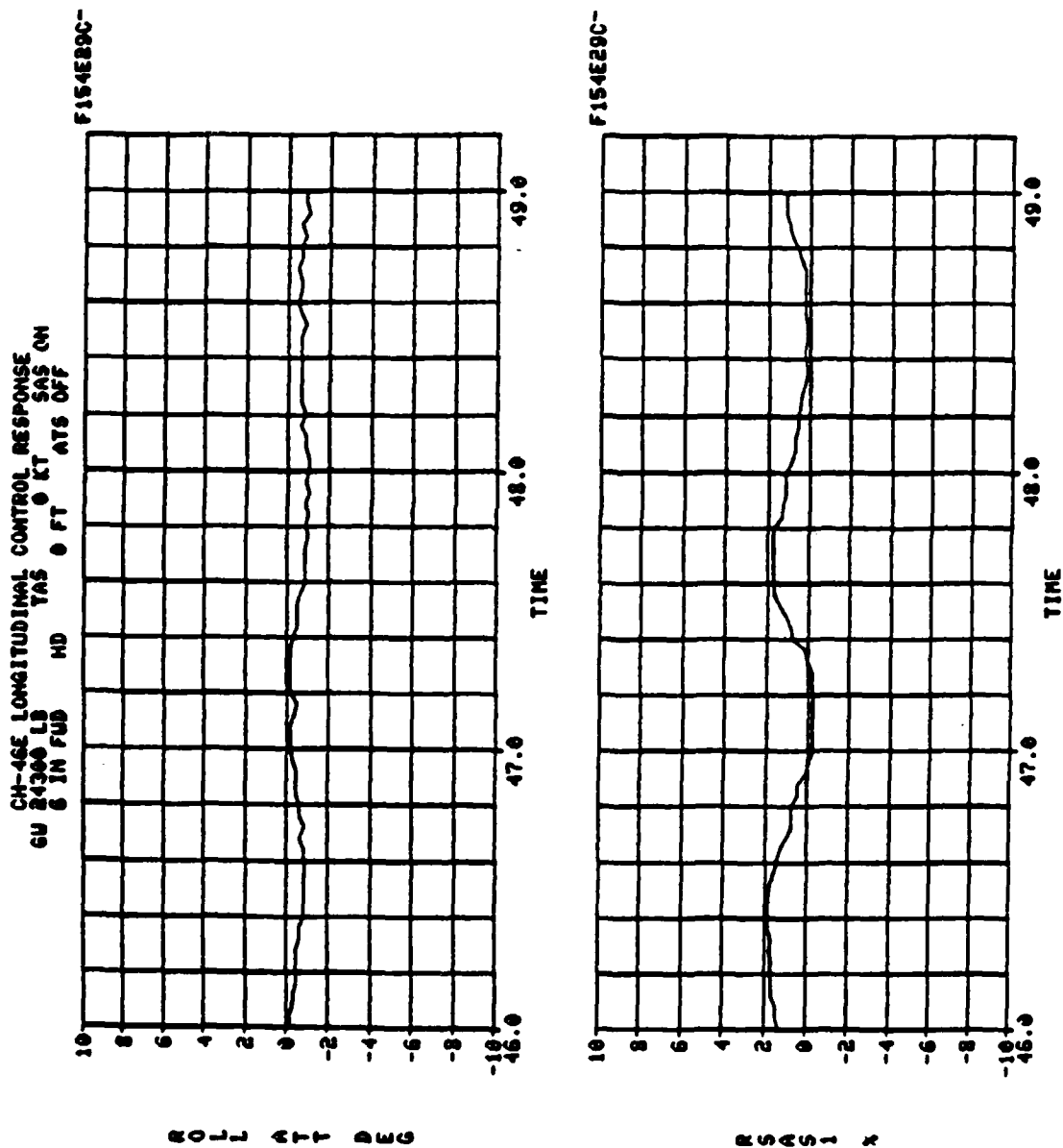


FIGURE 5F

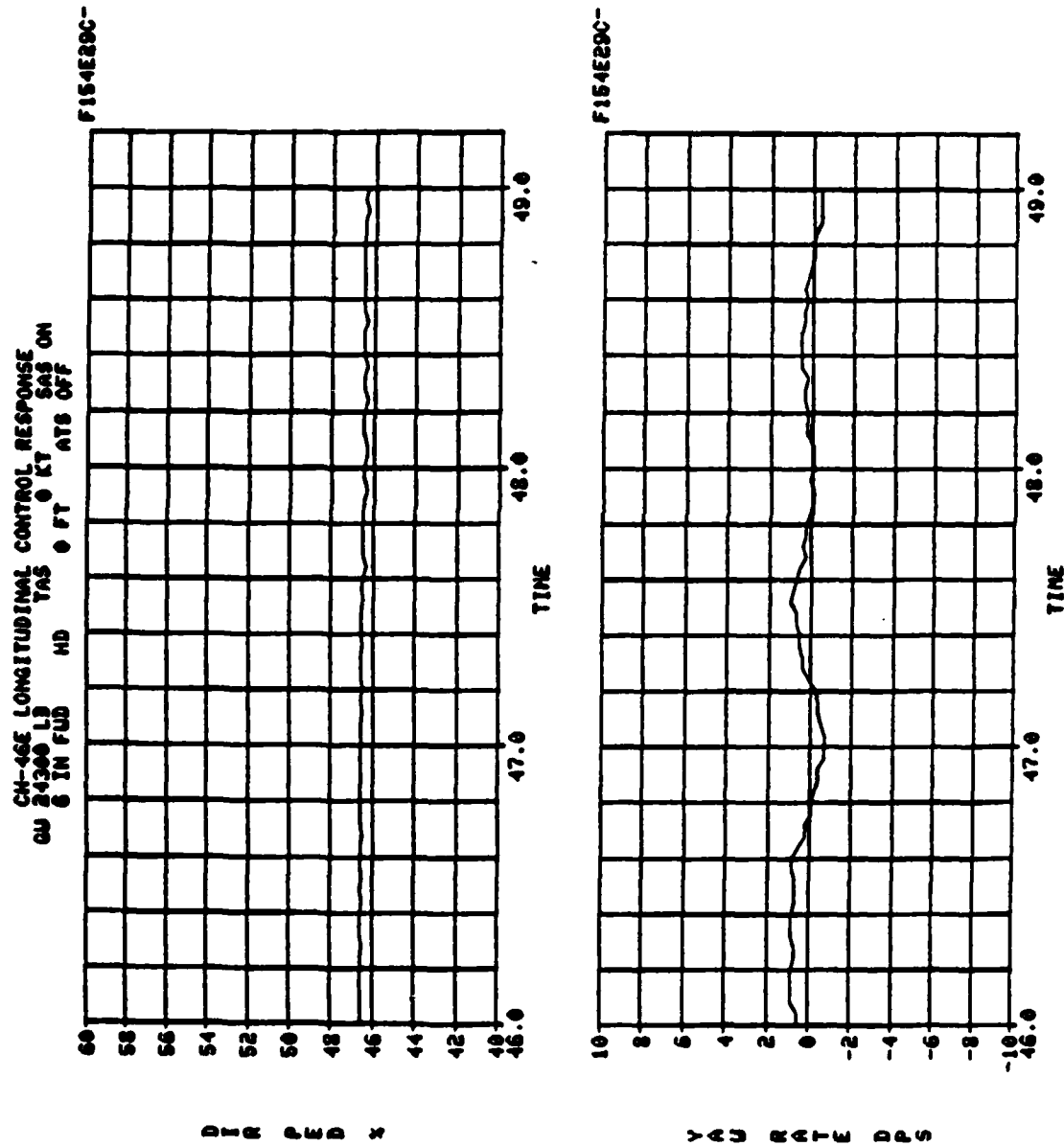


FIGURE 5G

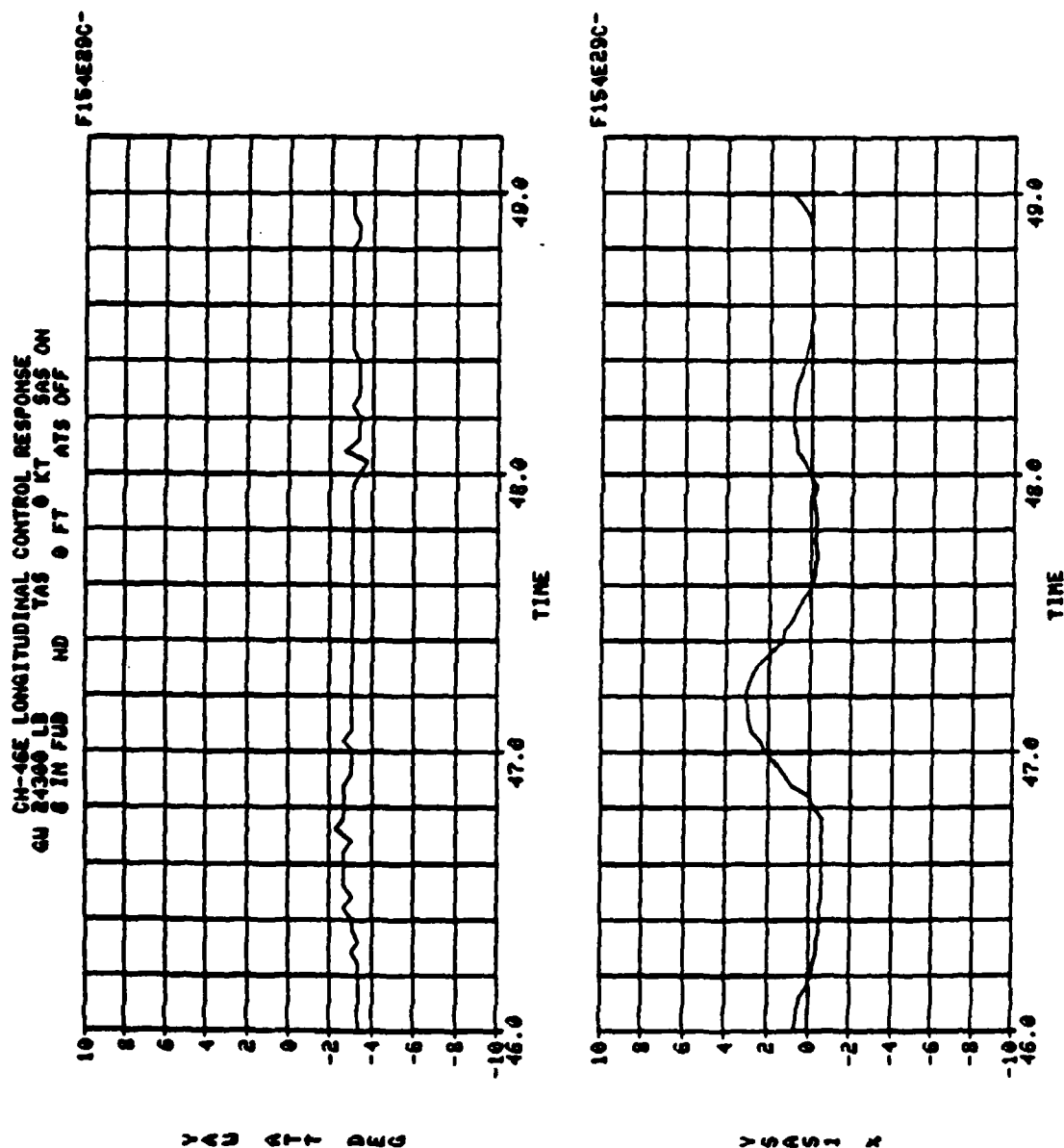


FIGURE 5H



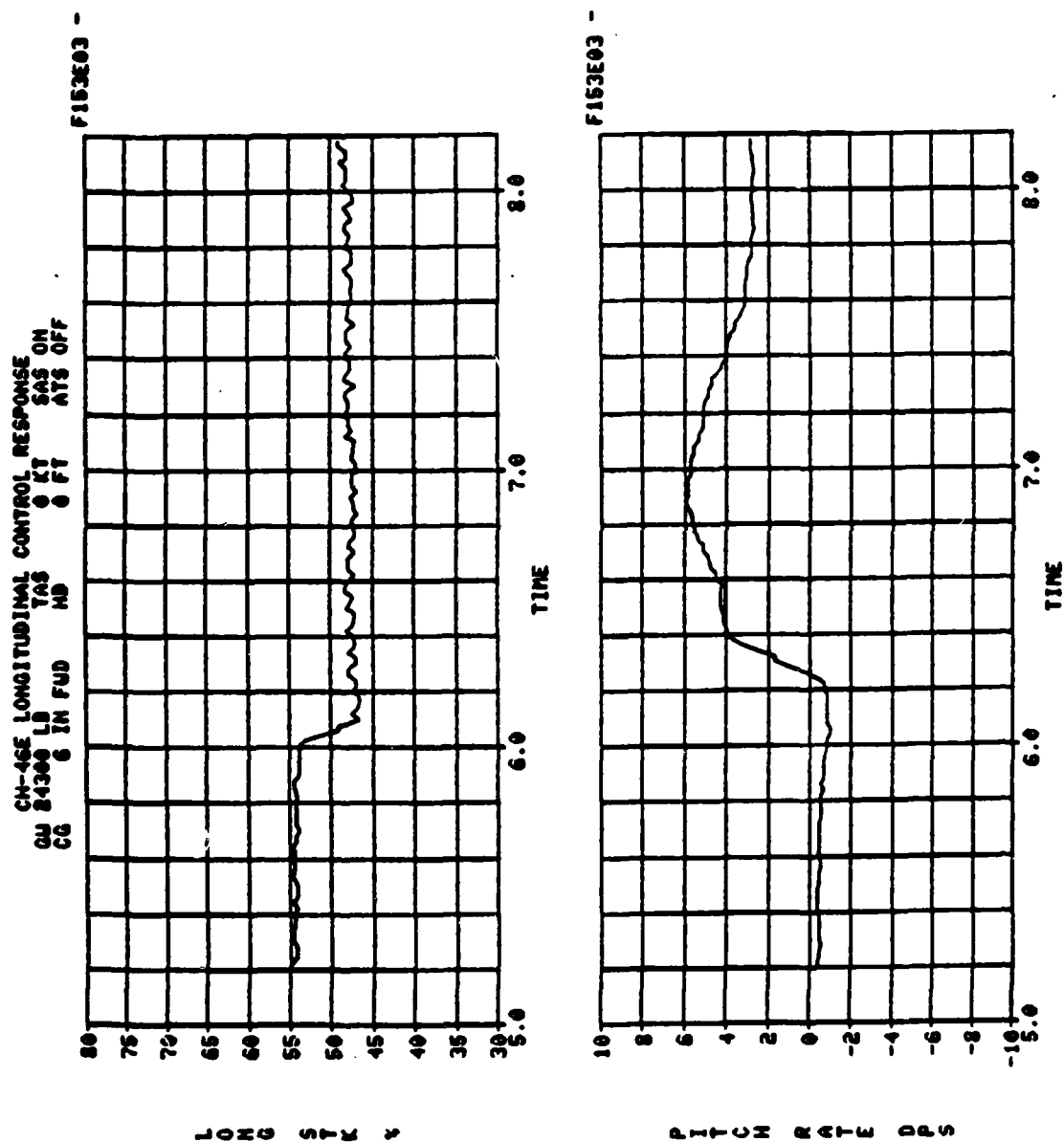


FIGURE 6A

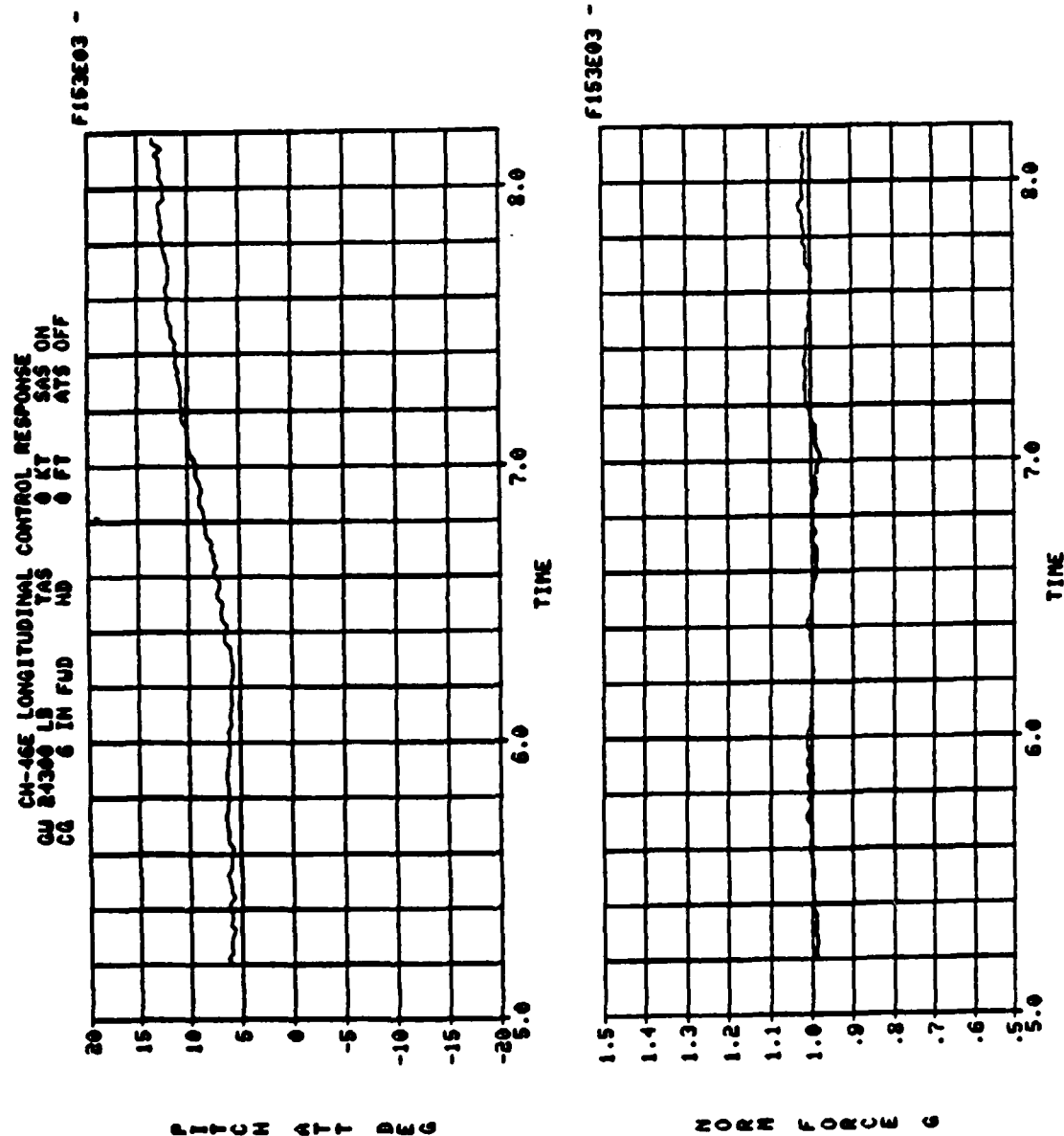


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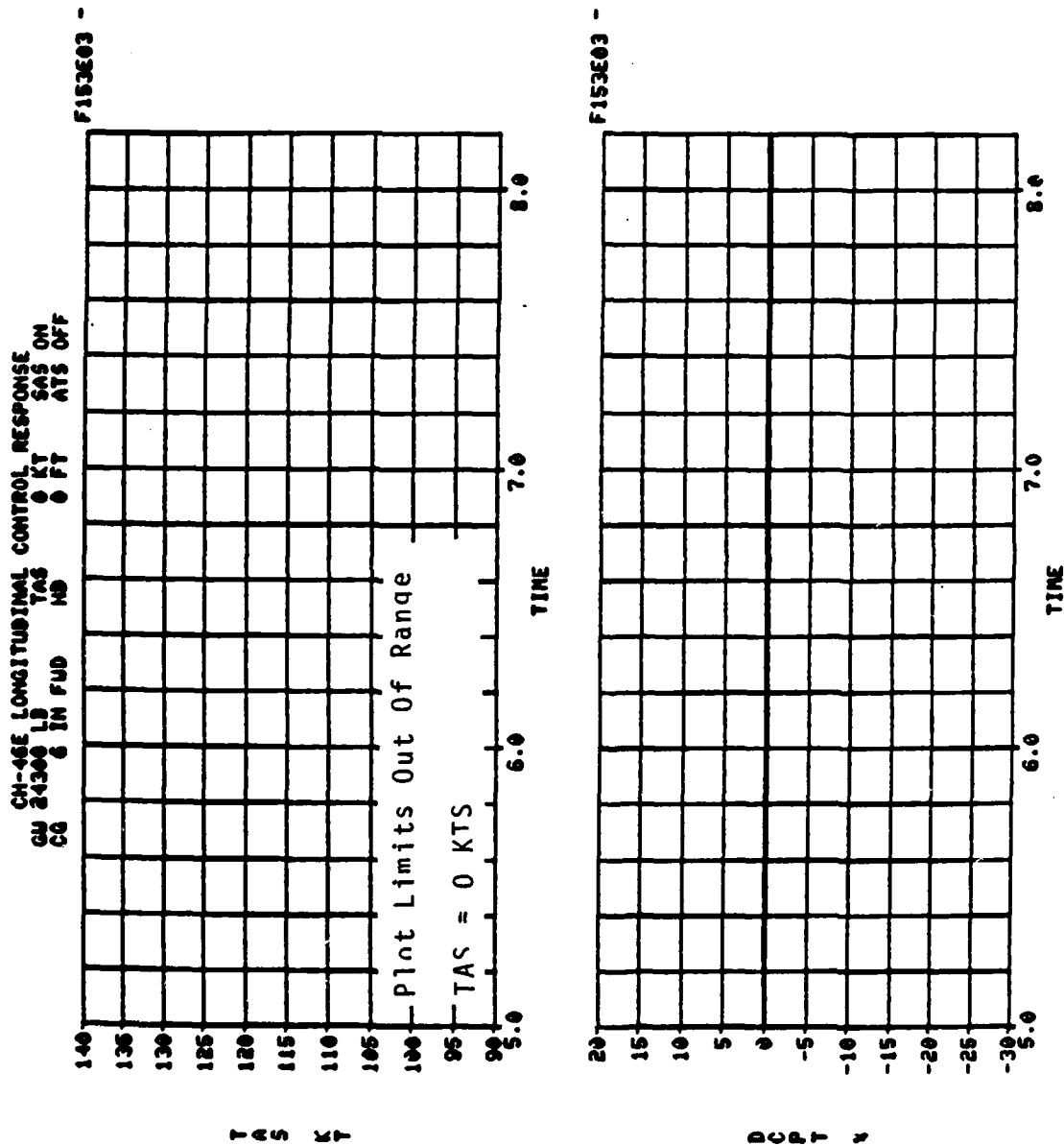


FIGURE 6C

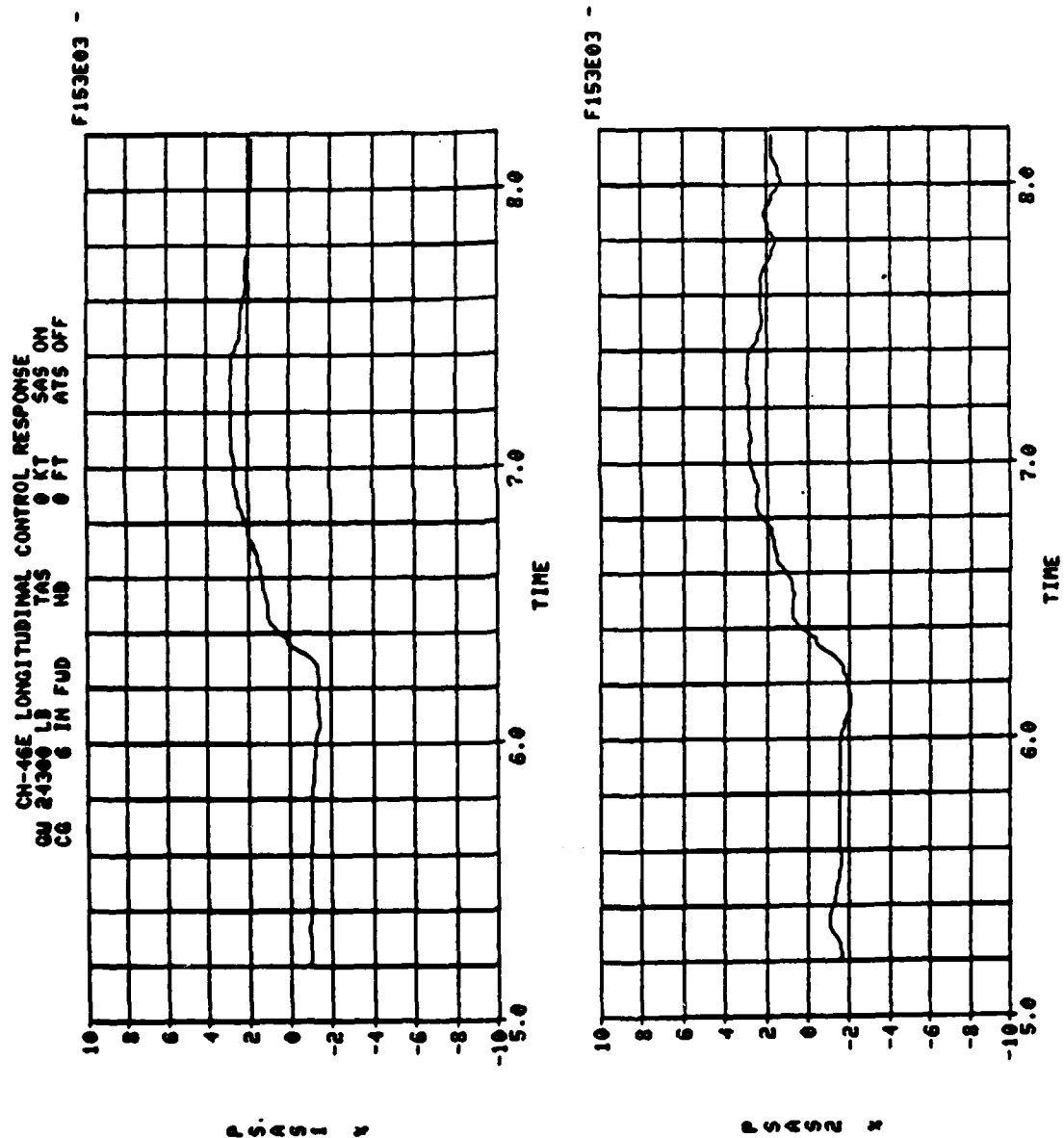


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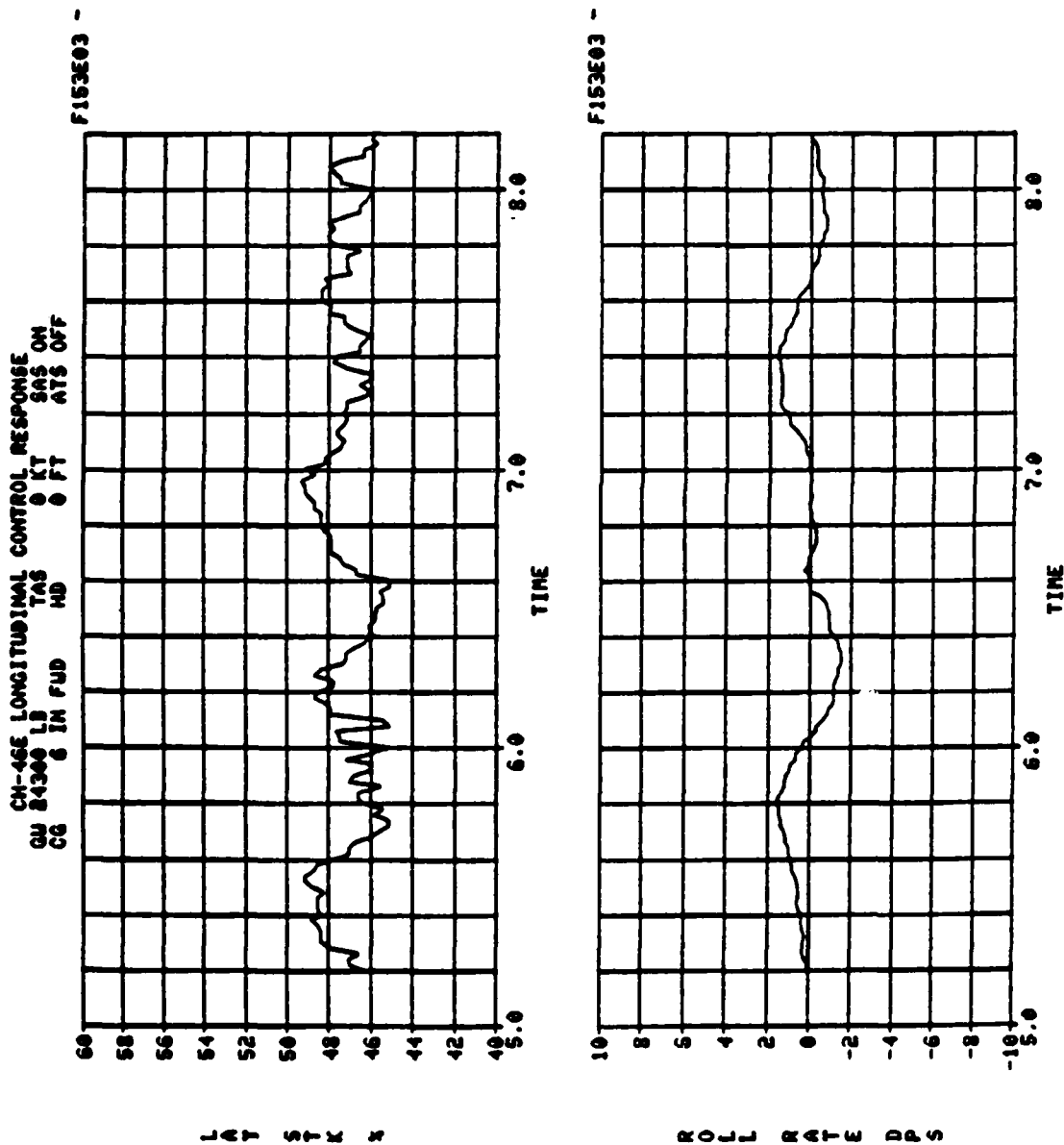


FIGURE 6E

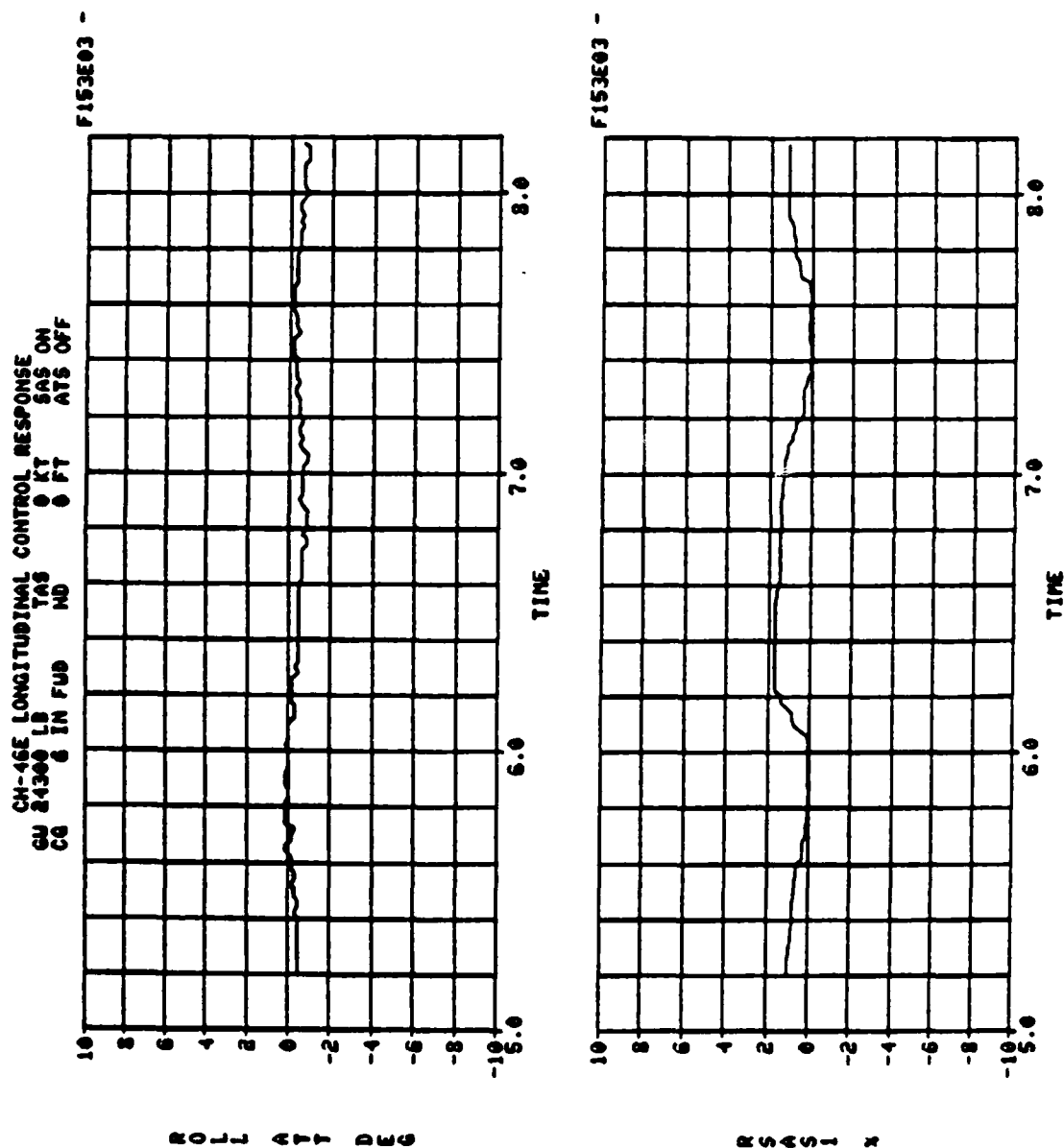


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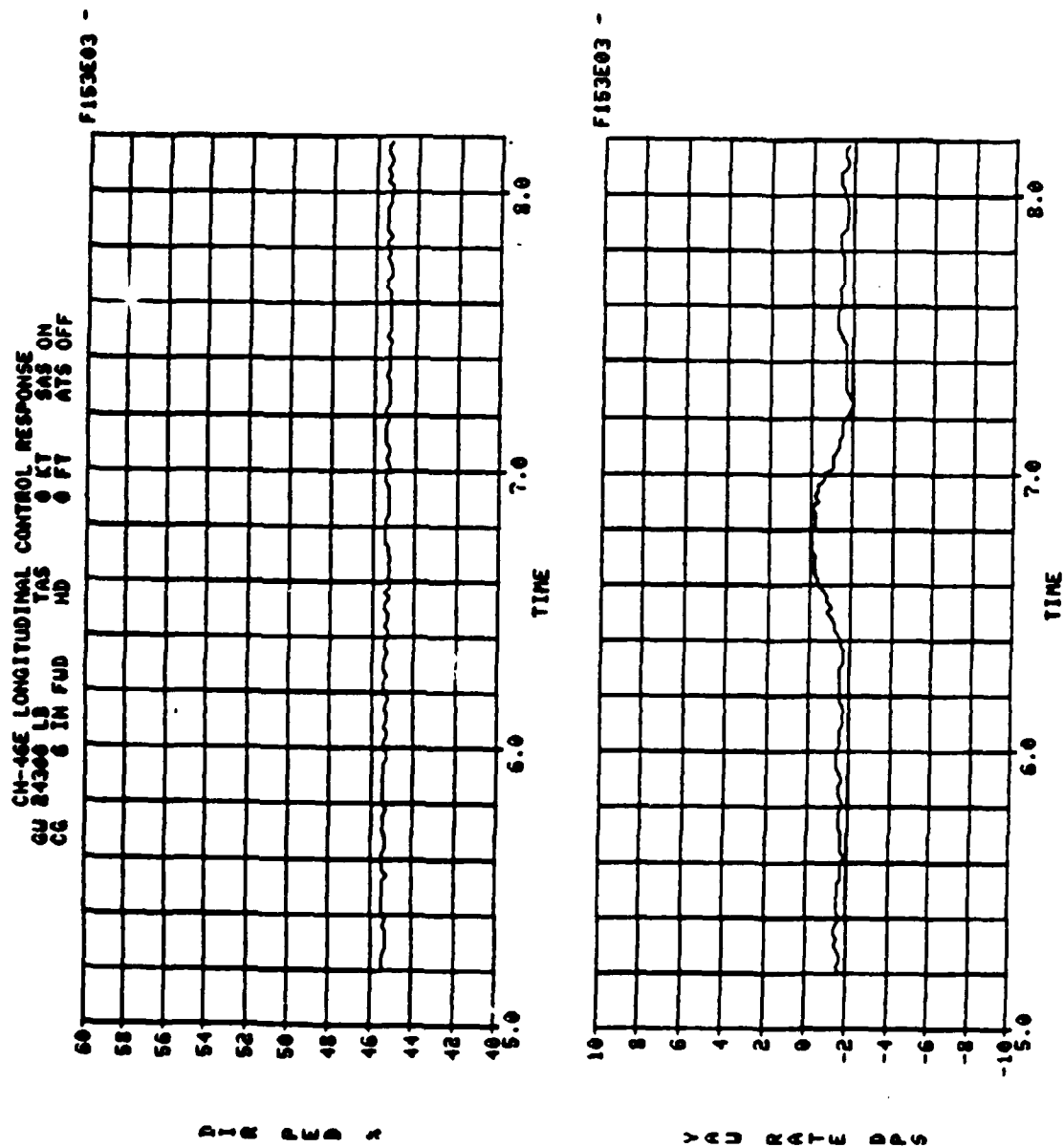


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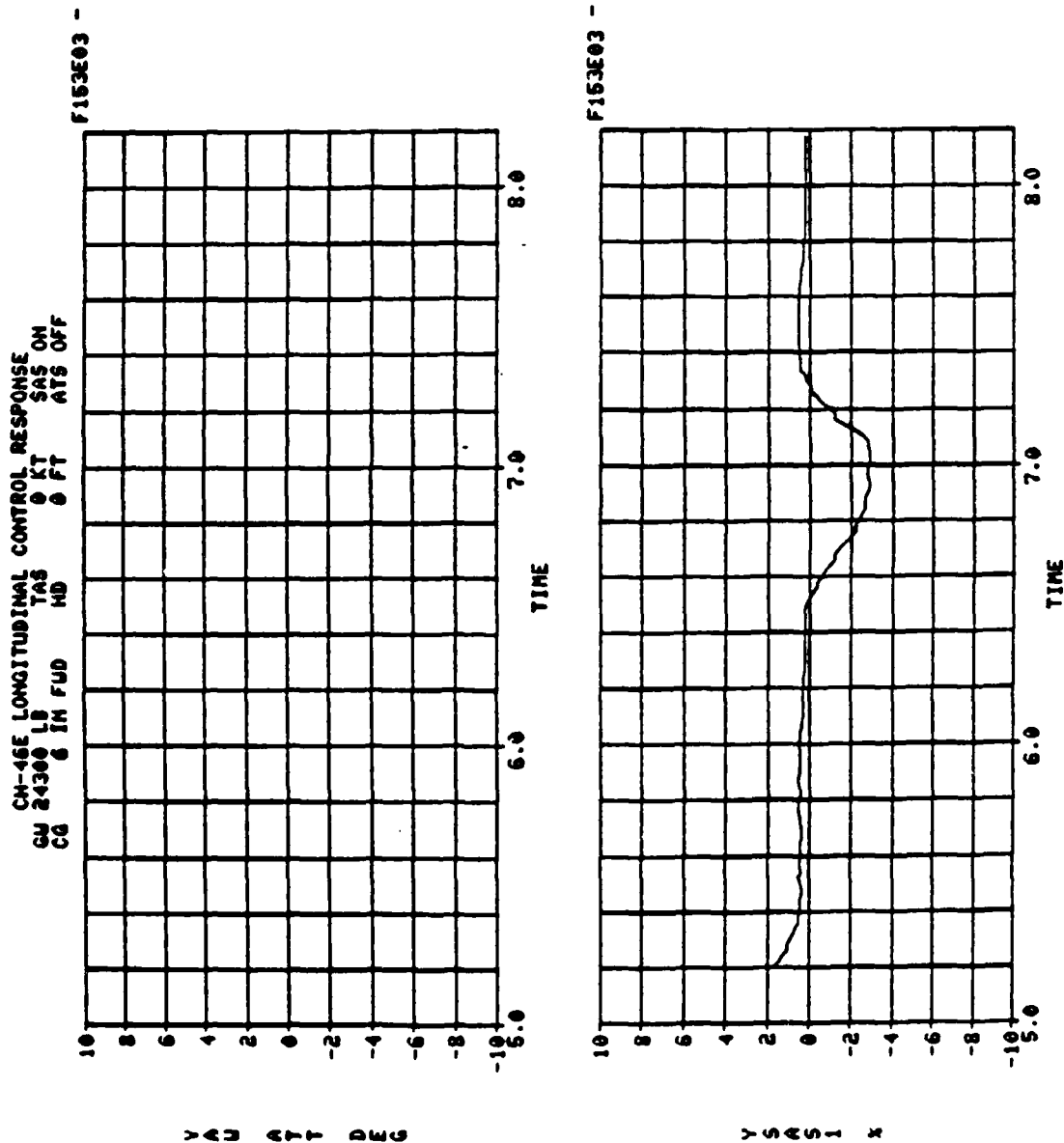


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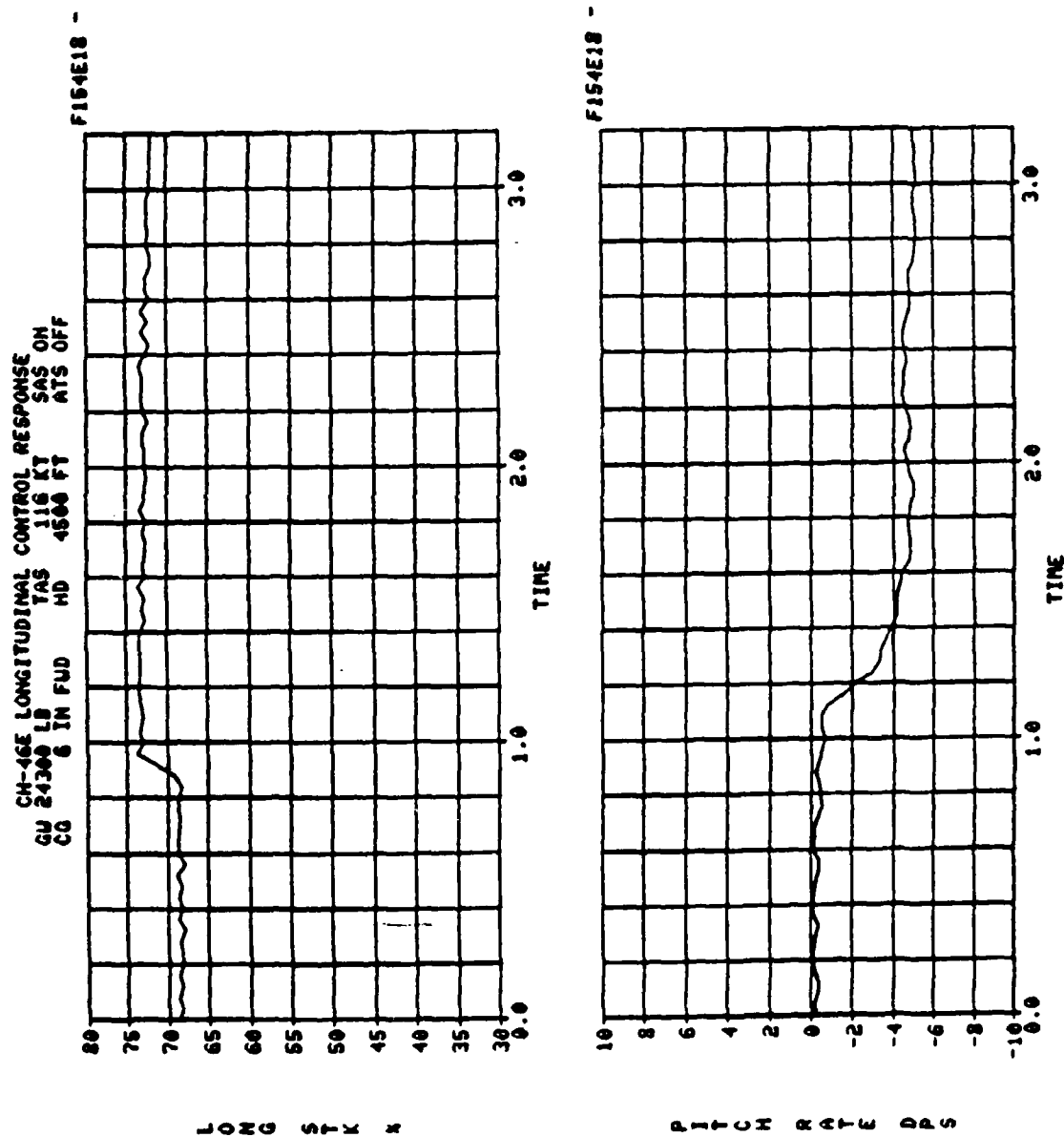


FIGURE 7A

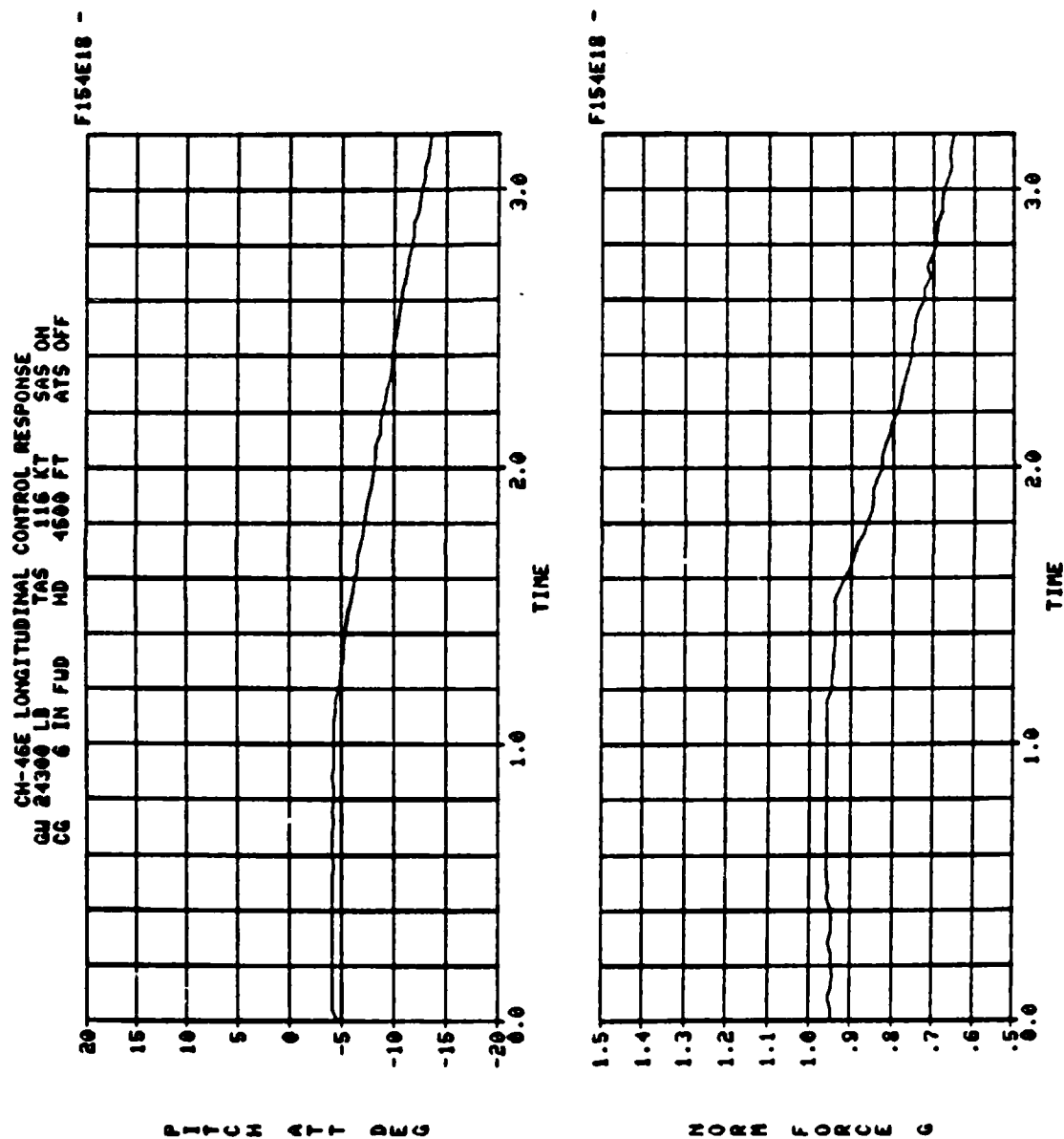


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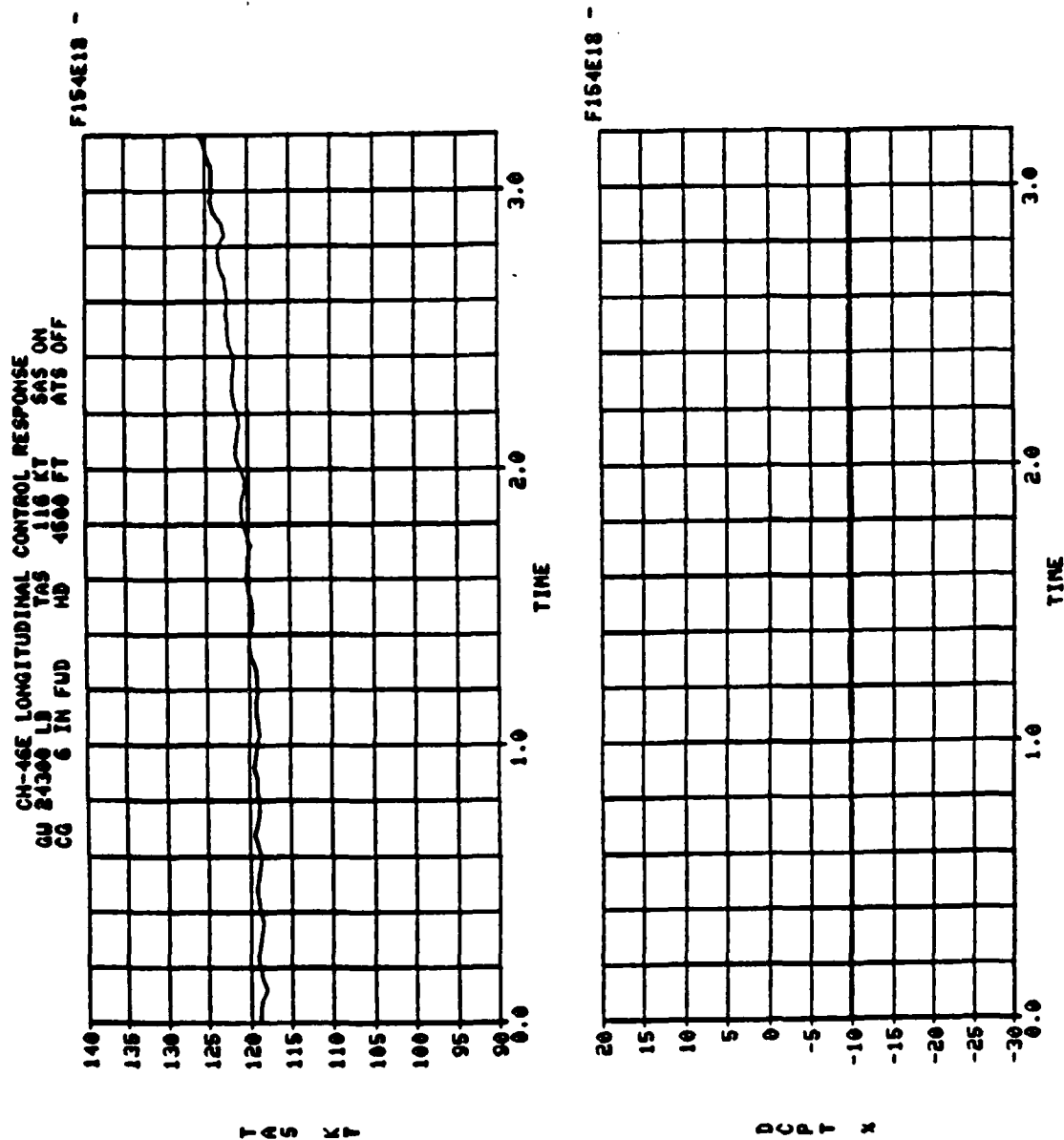


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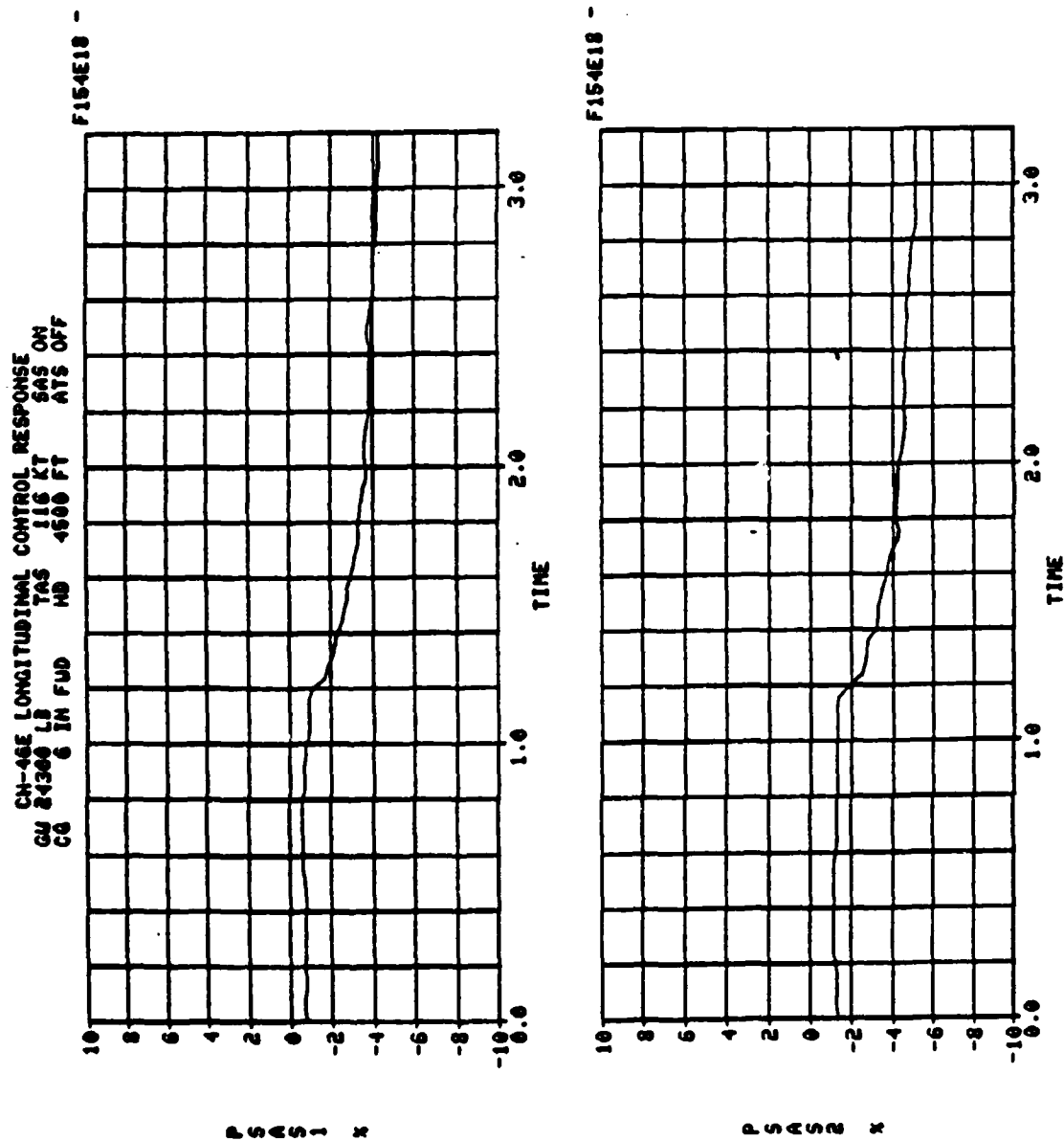


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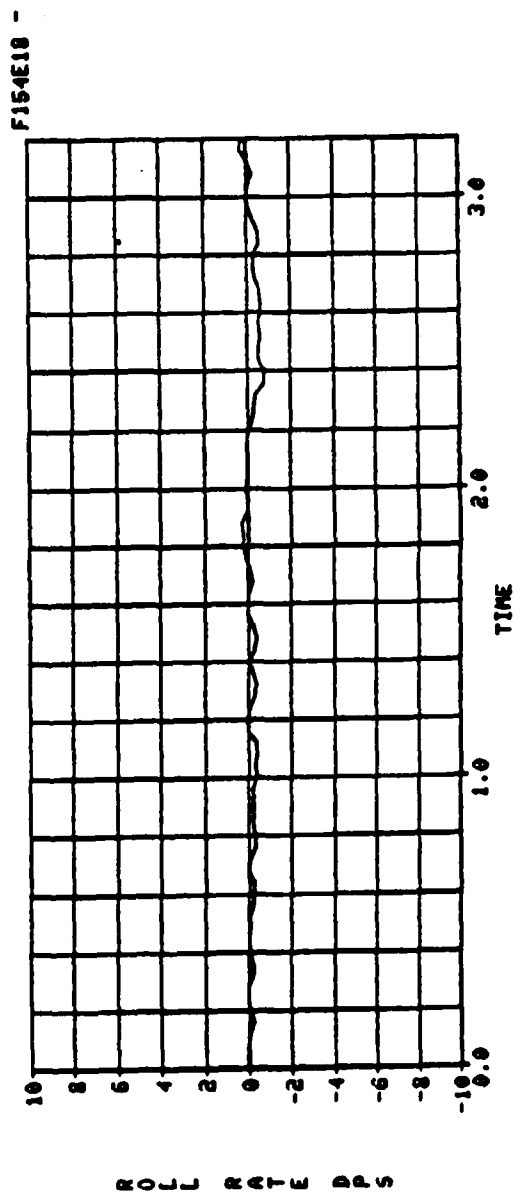
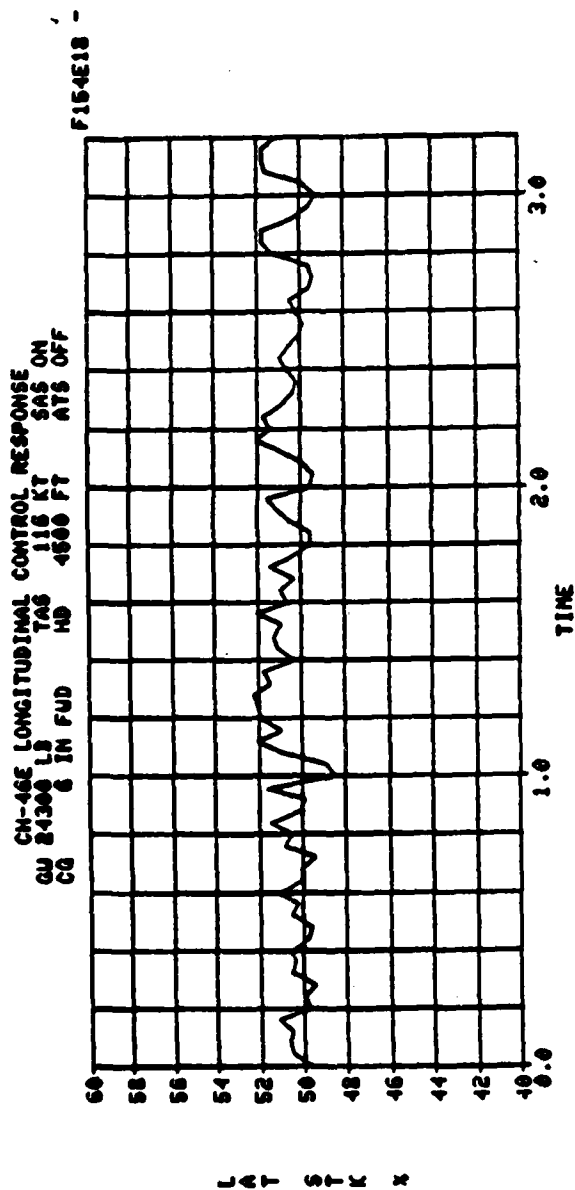


FIGURE 7E

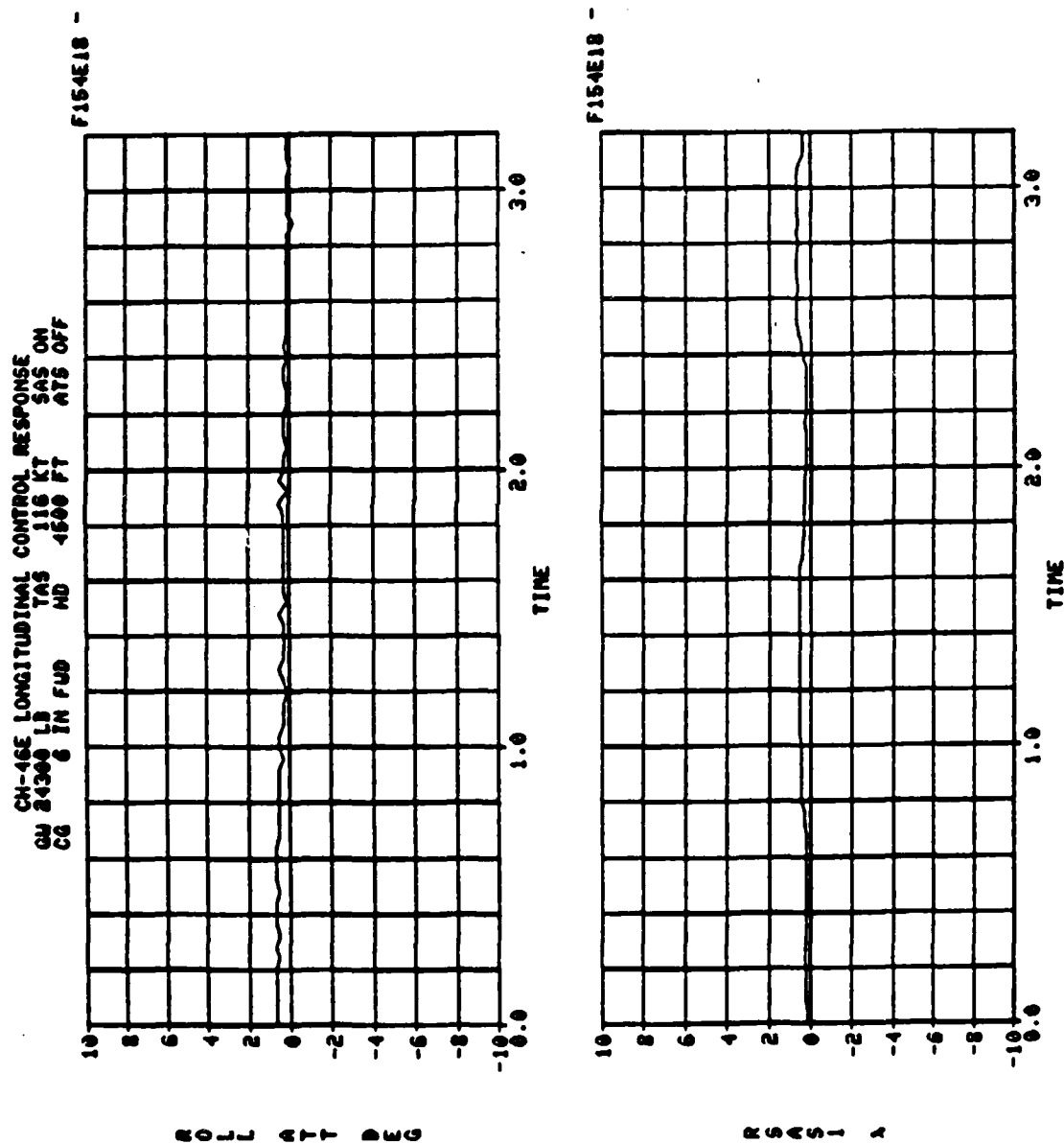


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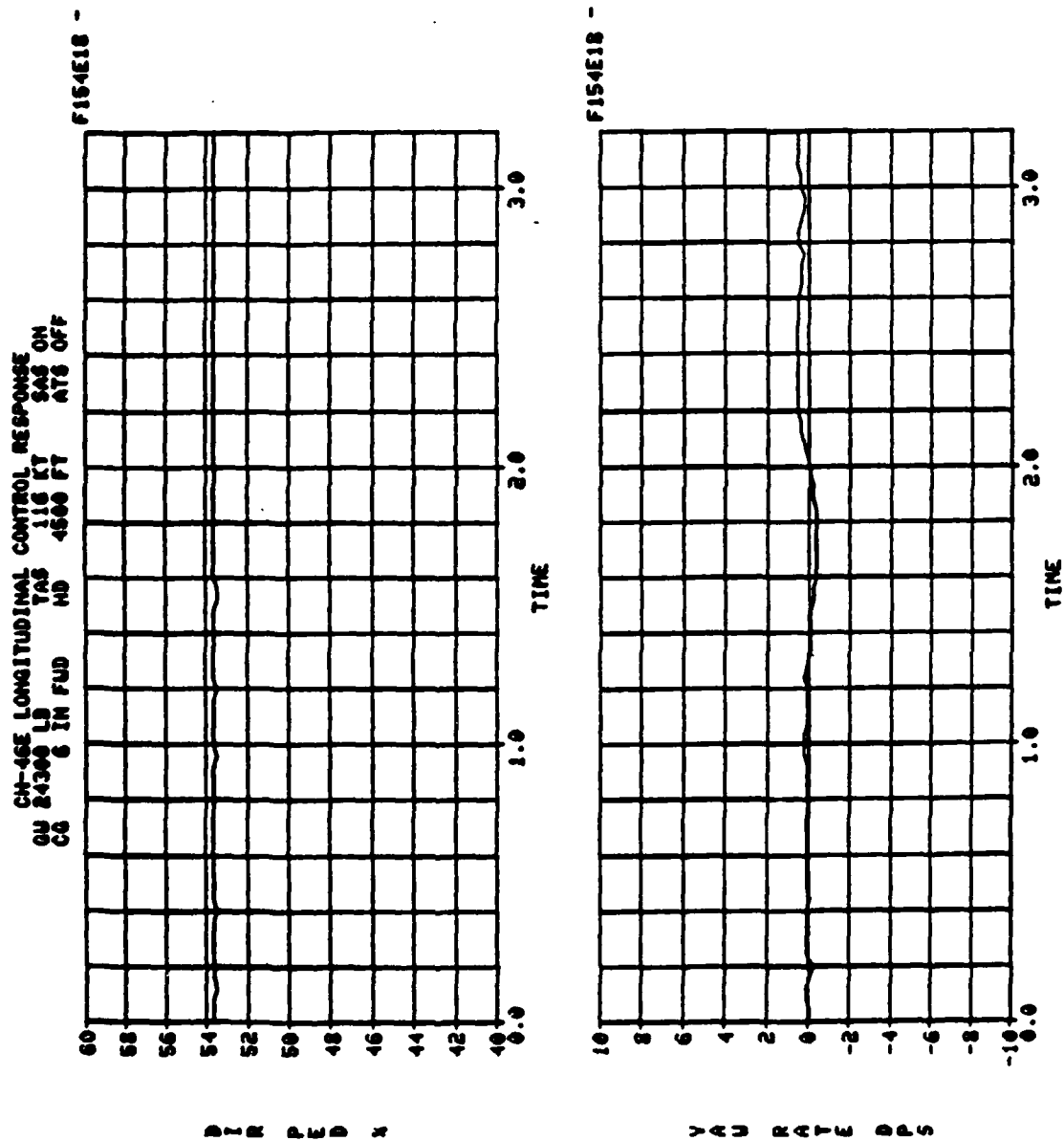


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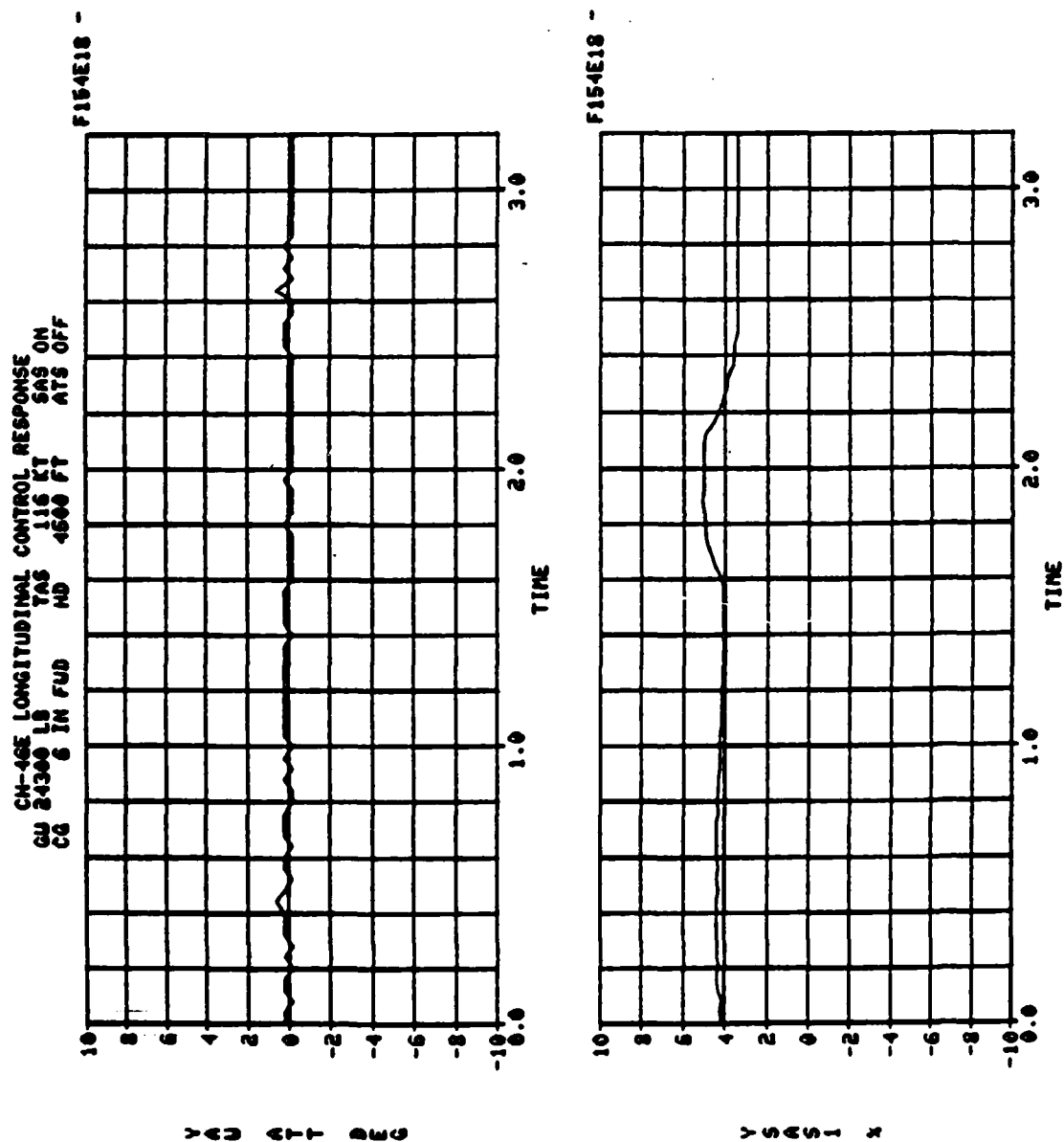


FIGURE 7H



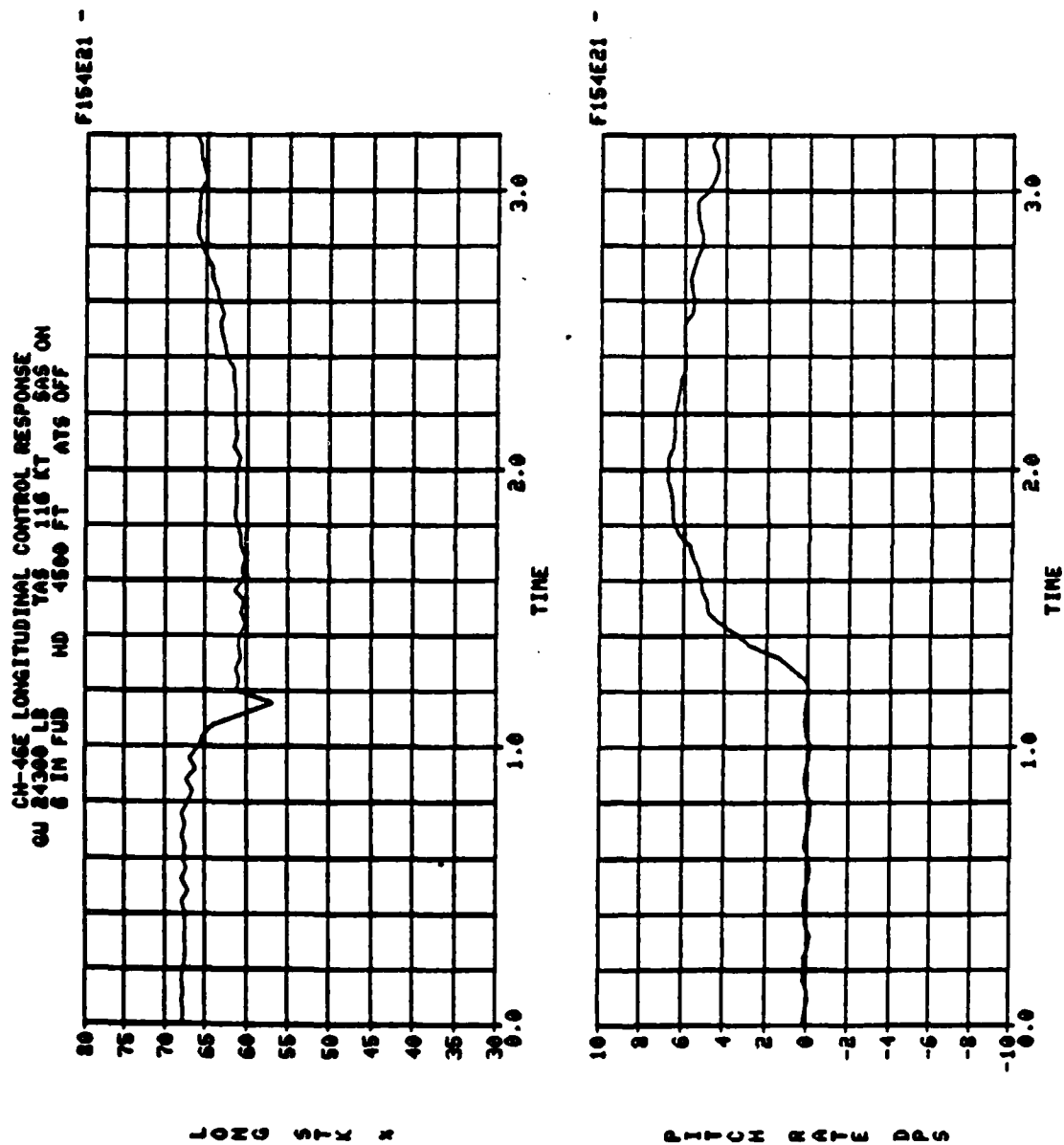


FIGURE 8A

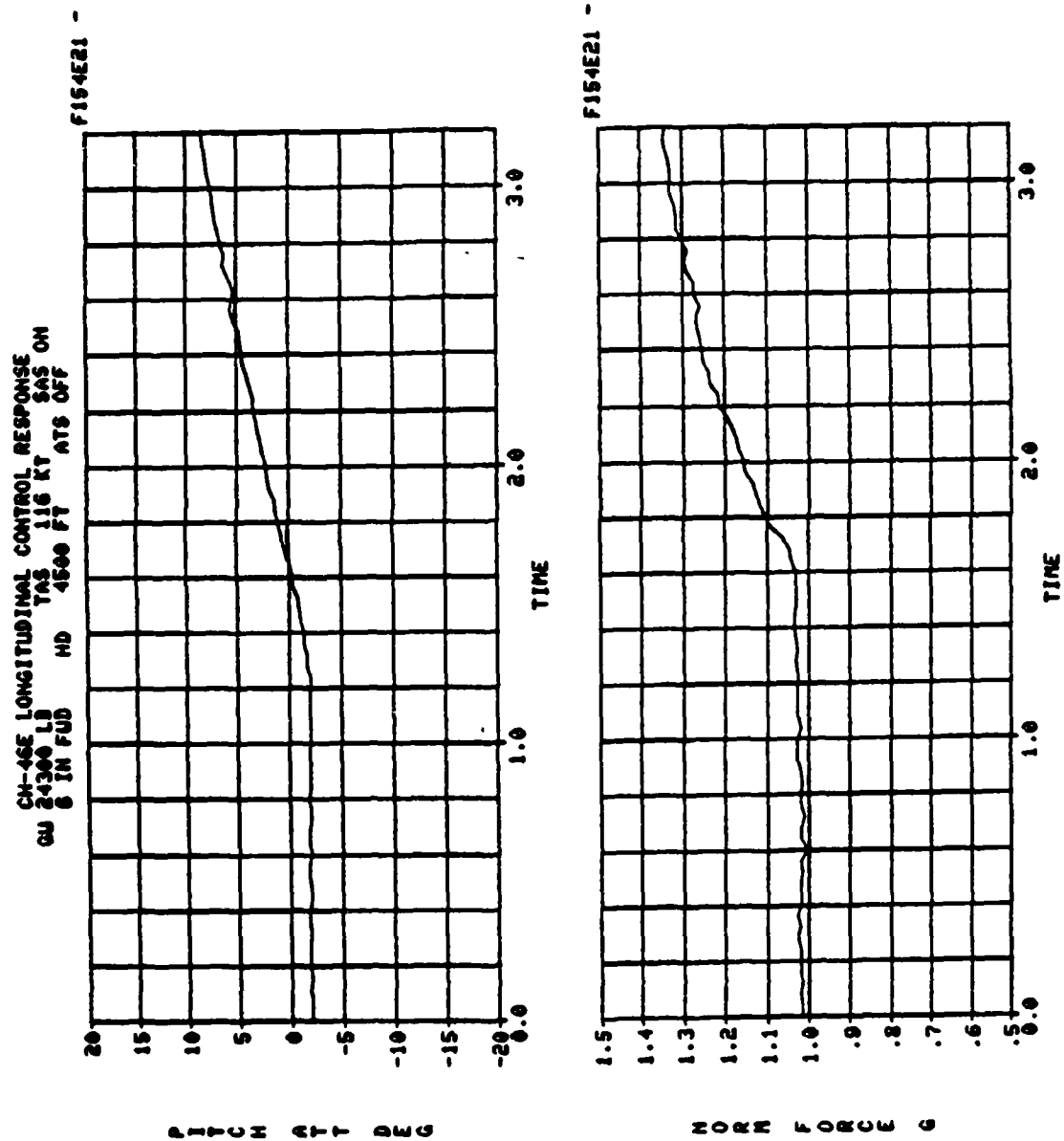


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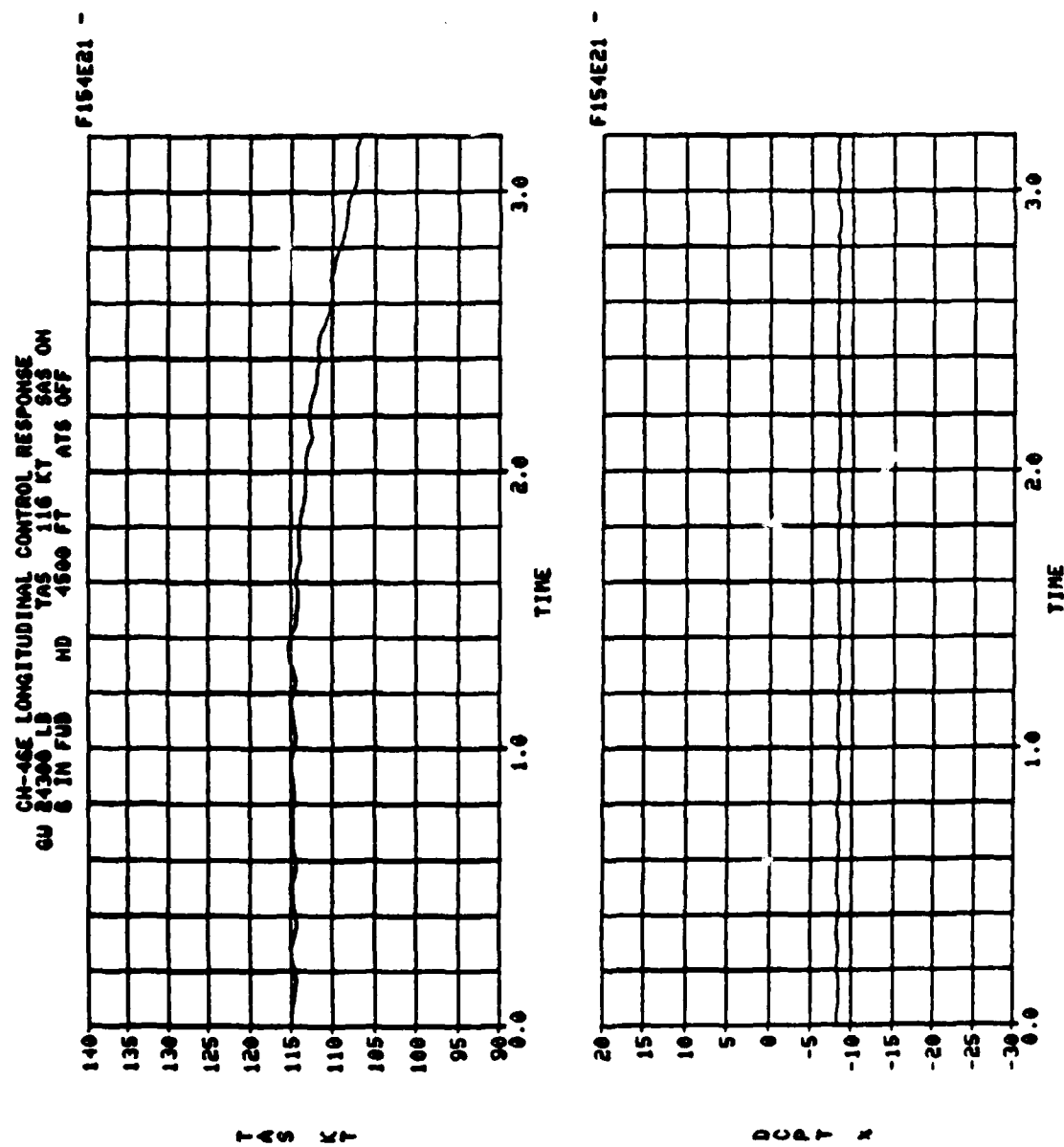


FIGURE 8C

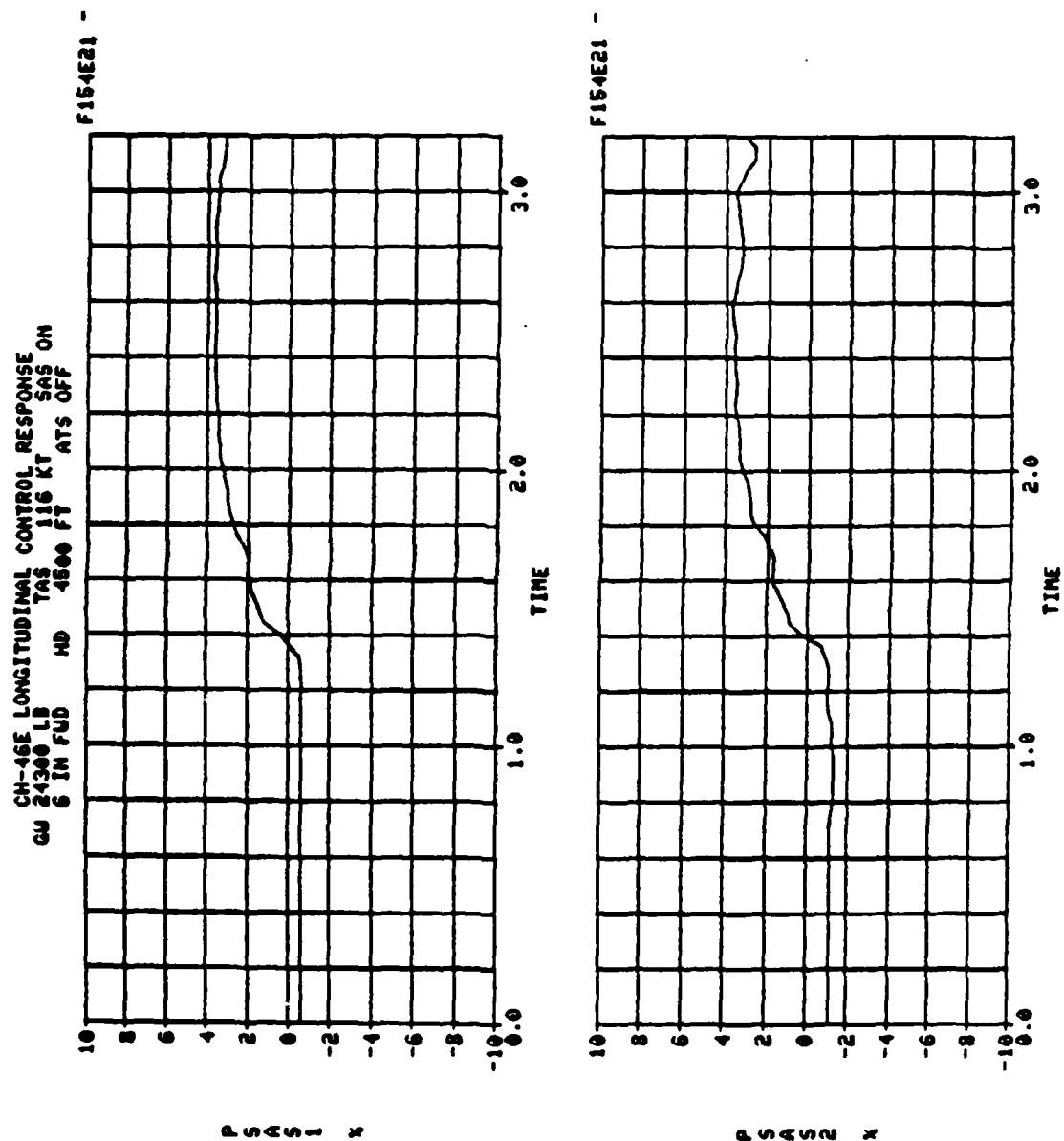


FIGURE 8D

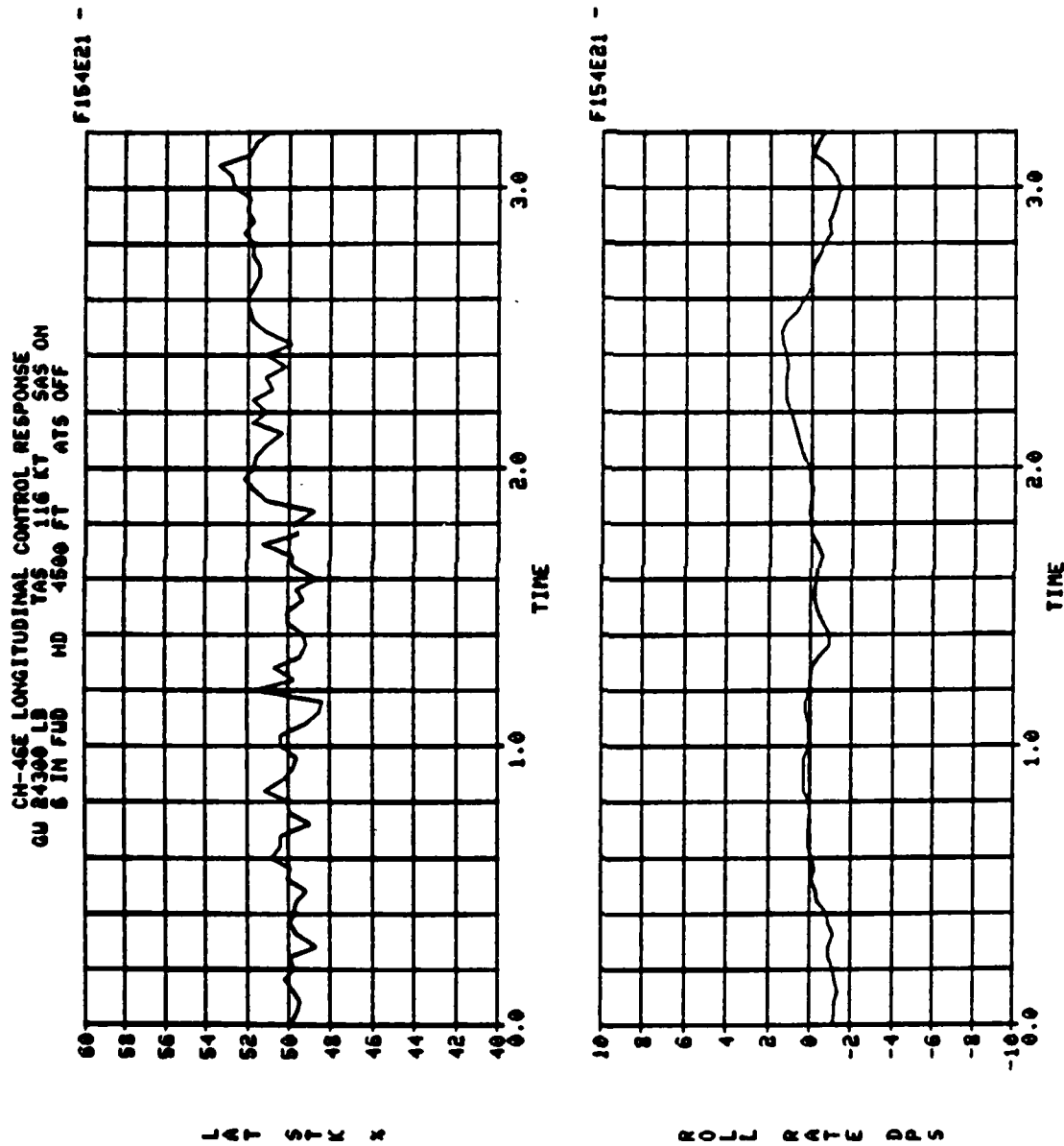


FIGURE 3E

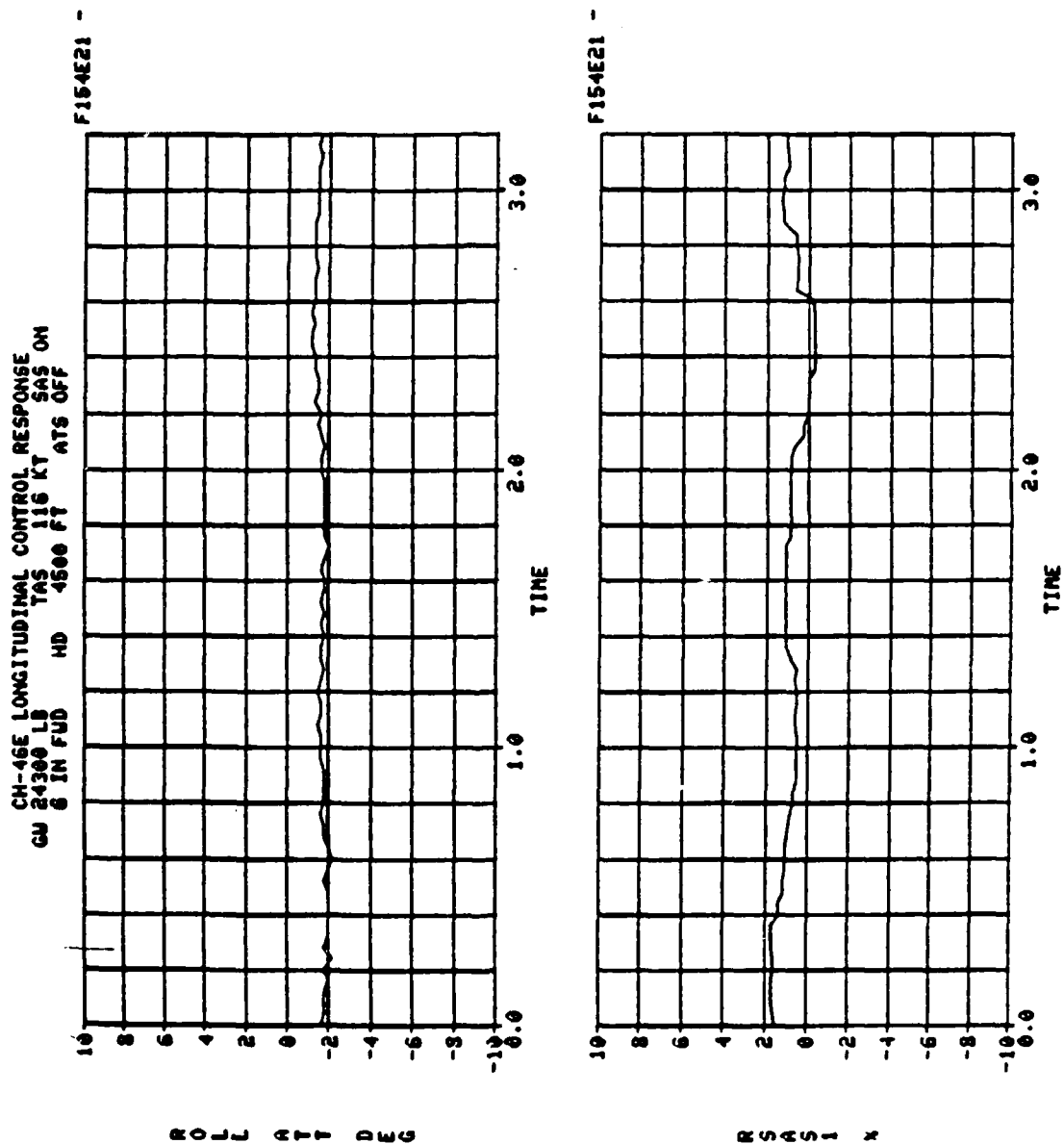


FIGURE 8F

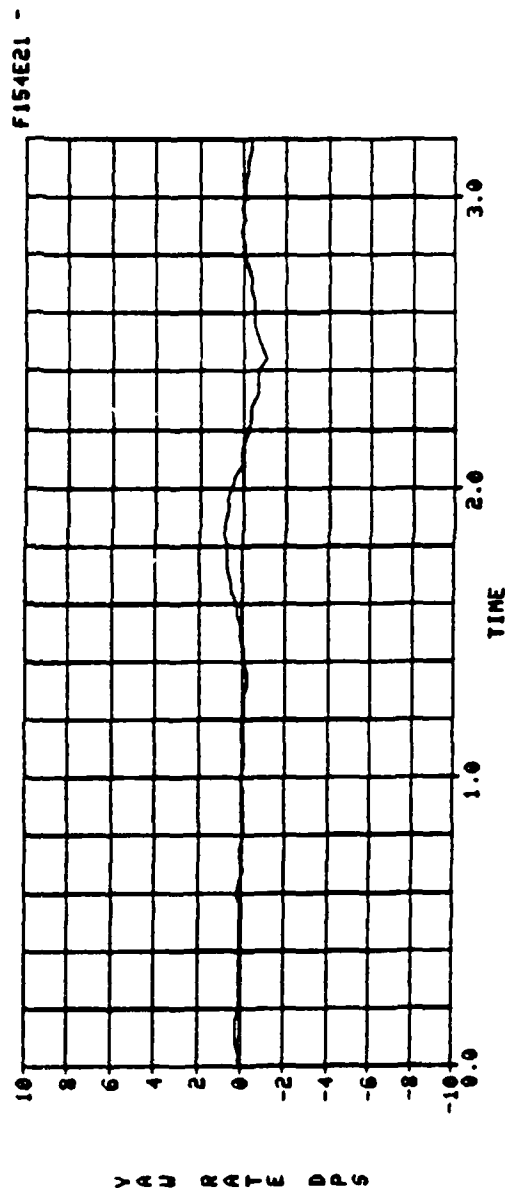
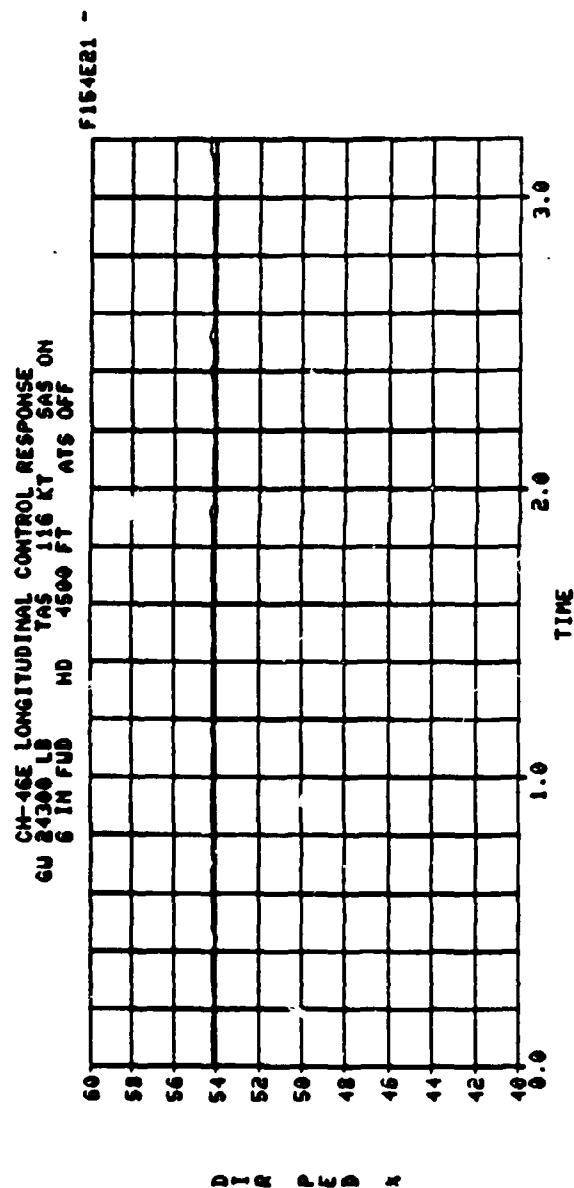


FIGURE 8G

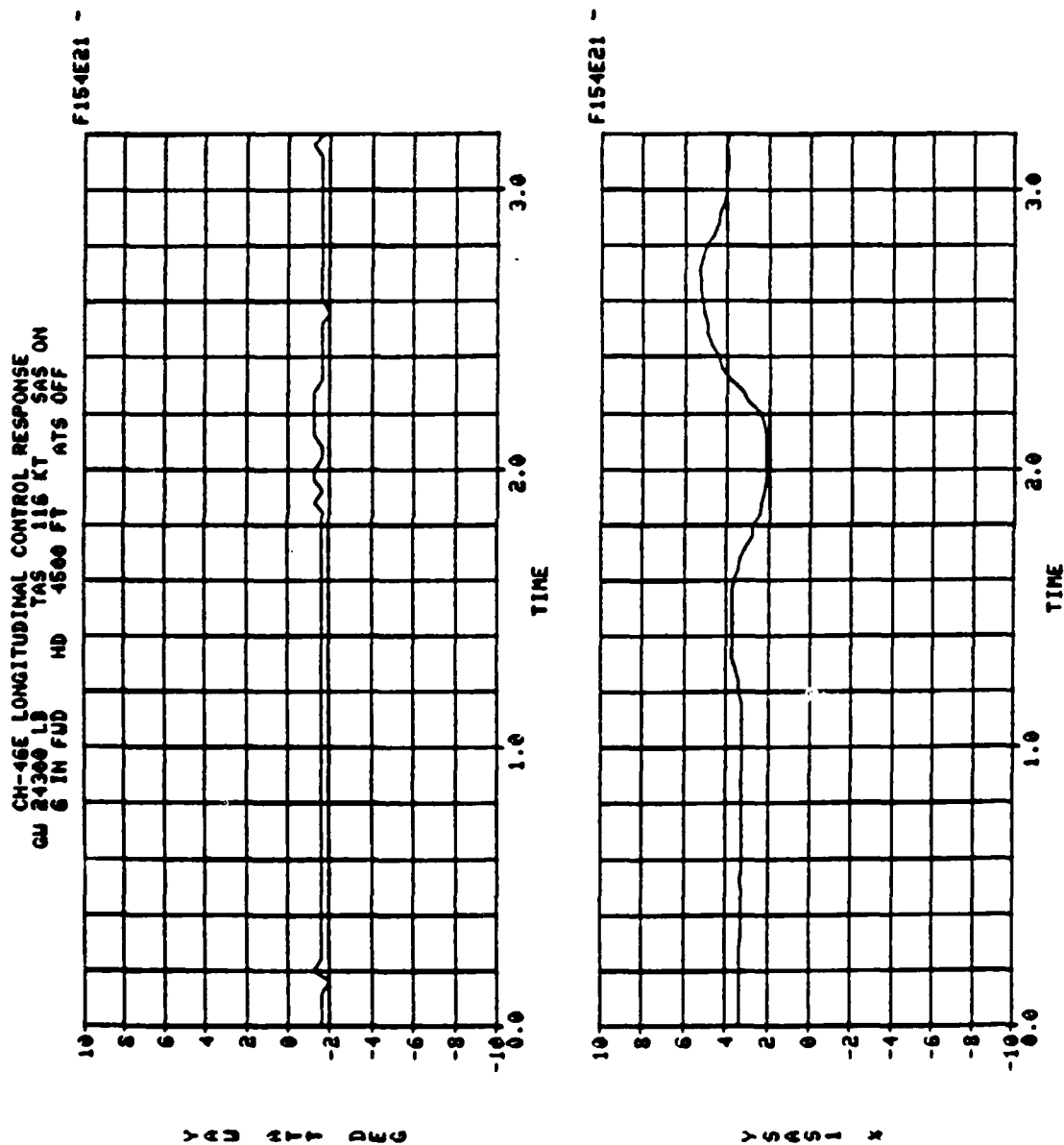


FIGURE 8H



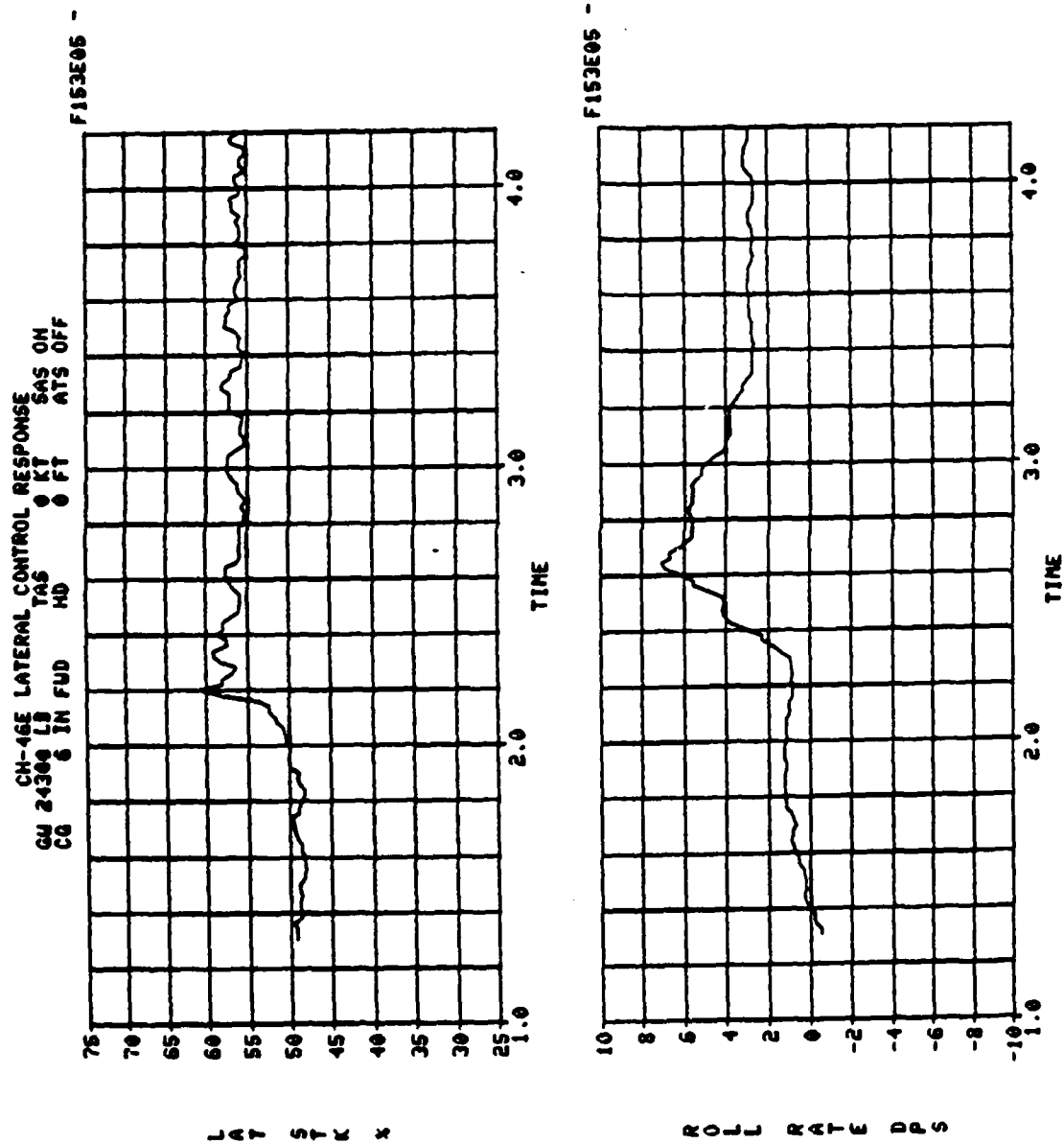


FIGURE 9A

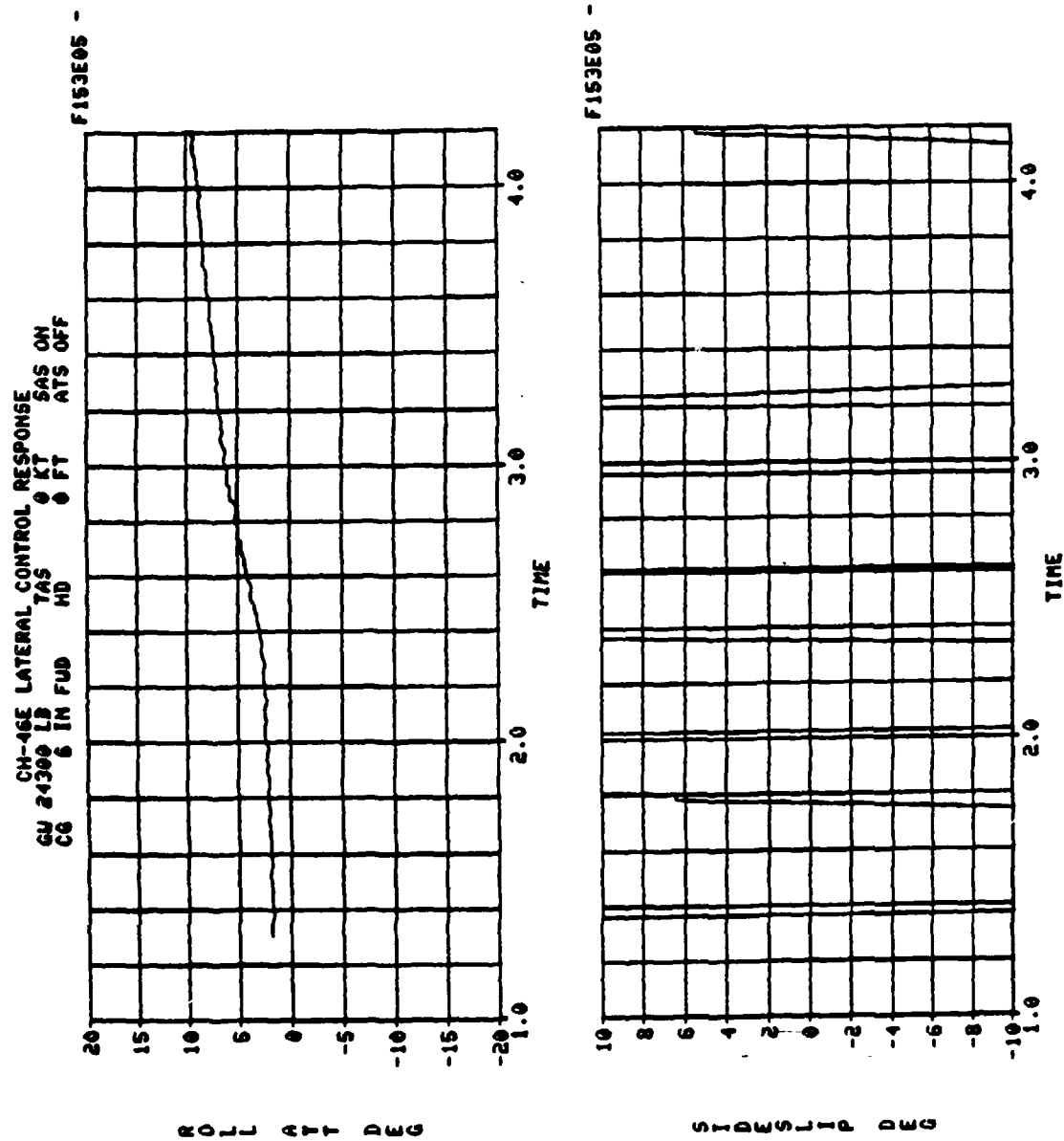


FIGURE 9B

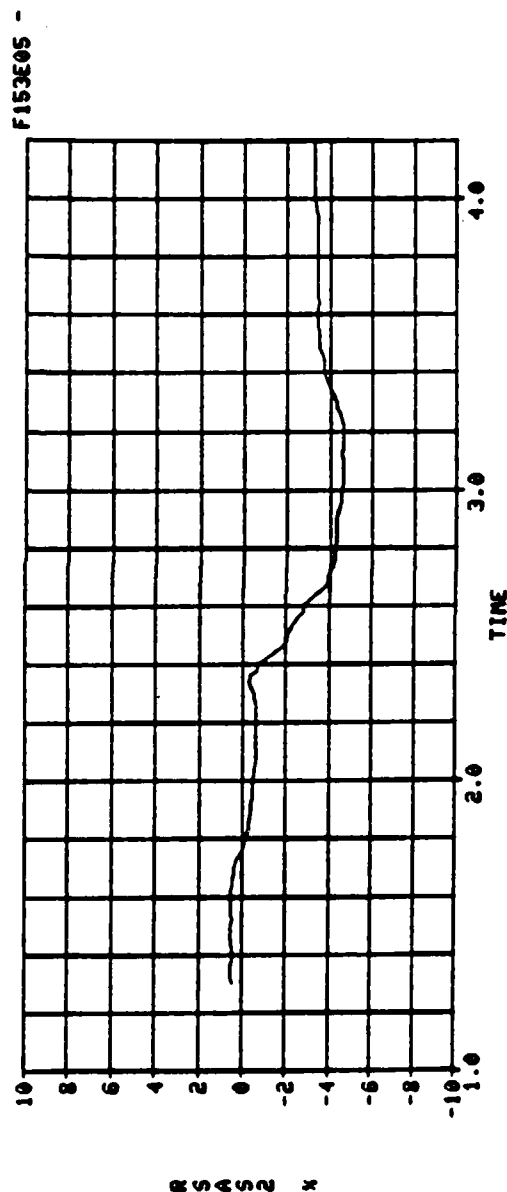
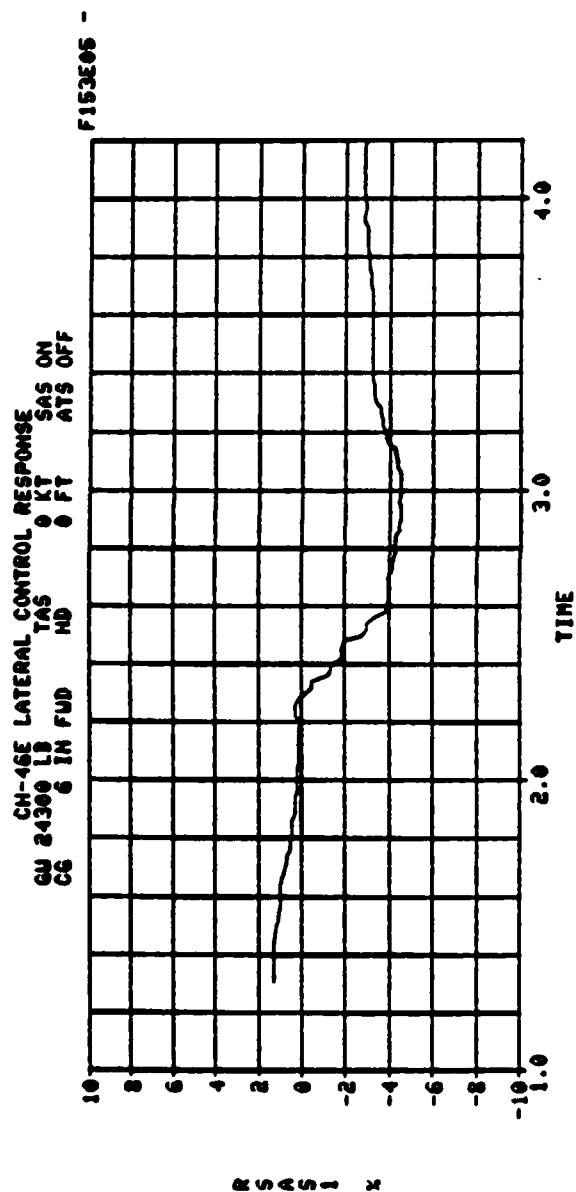


FIGURE 9C

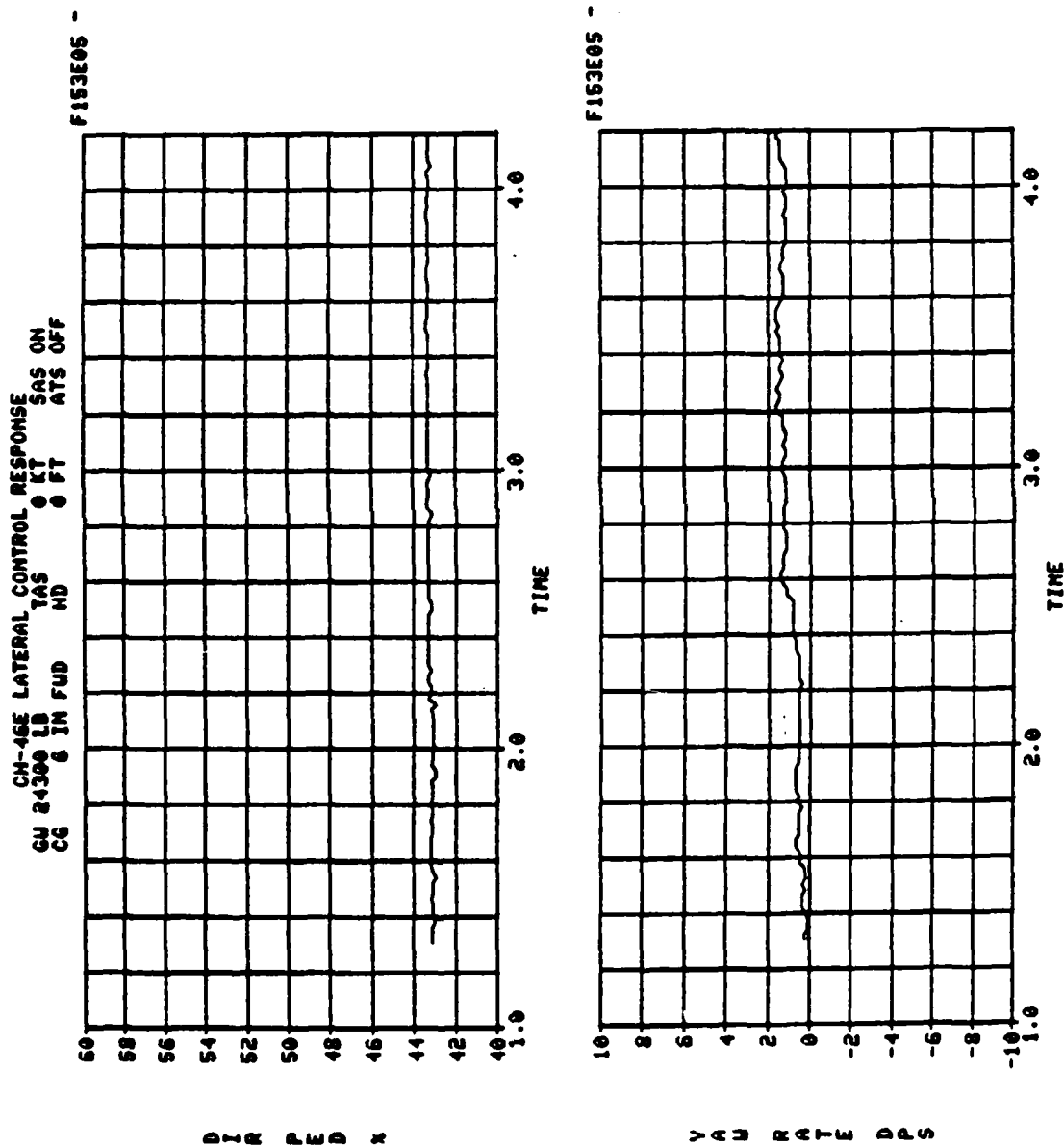


FIGURE 90

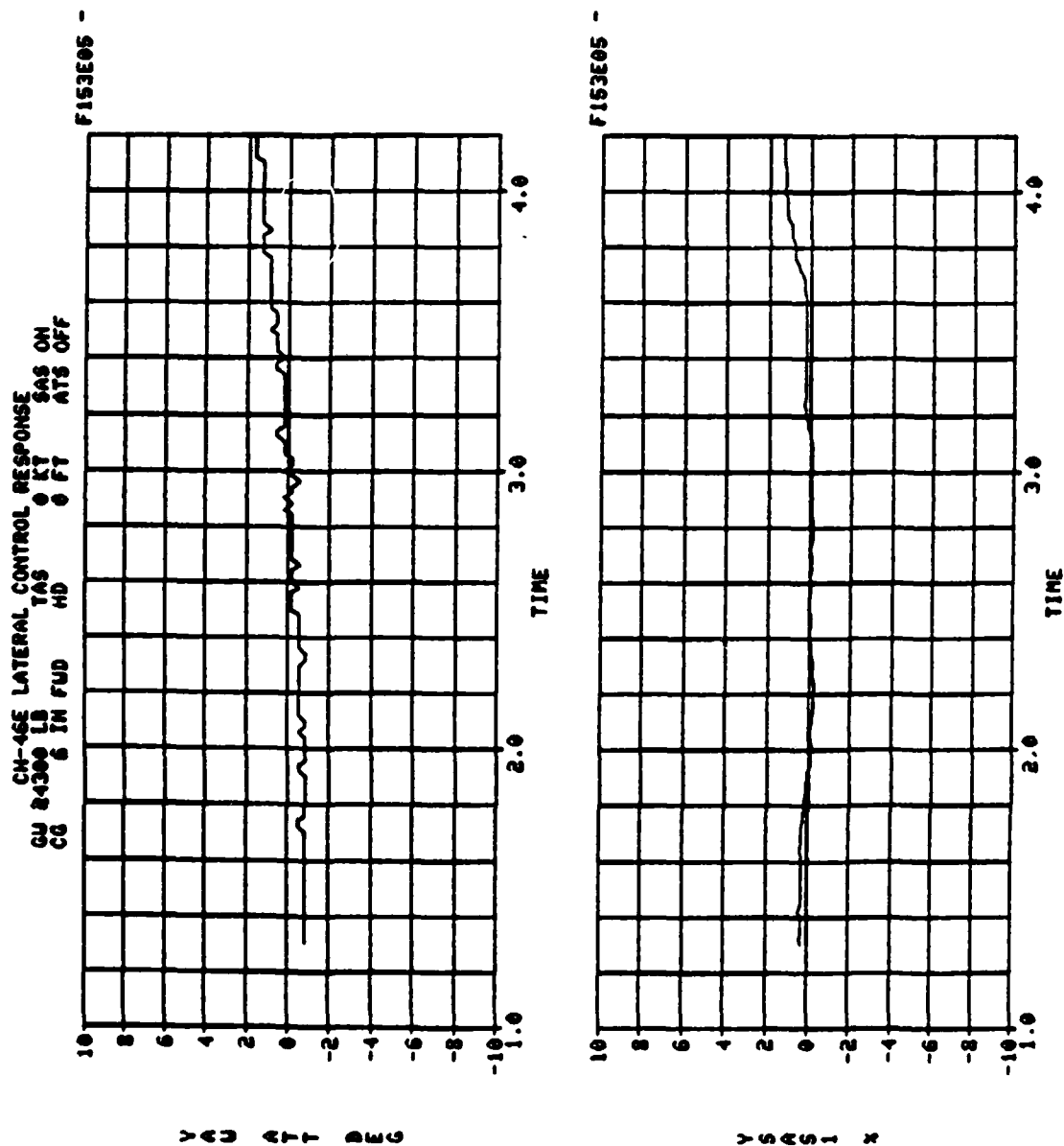


FIGURE 9E

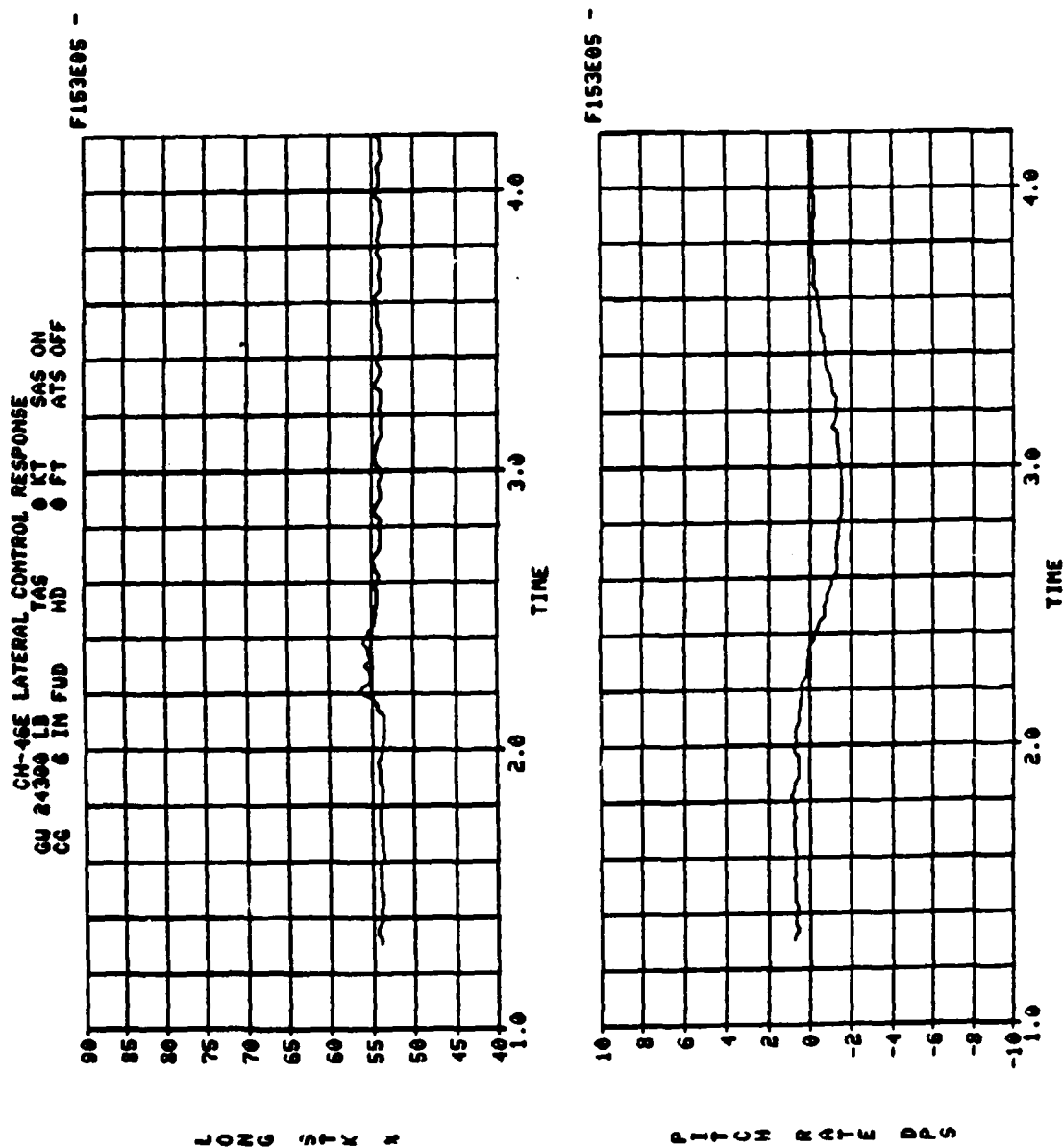


FIGURE 9F

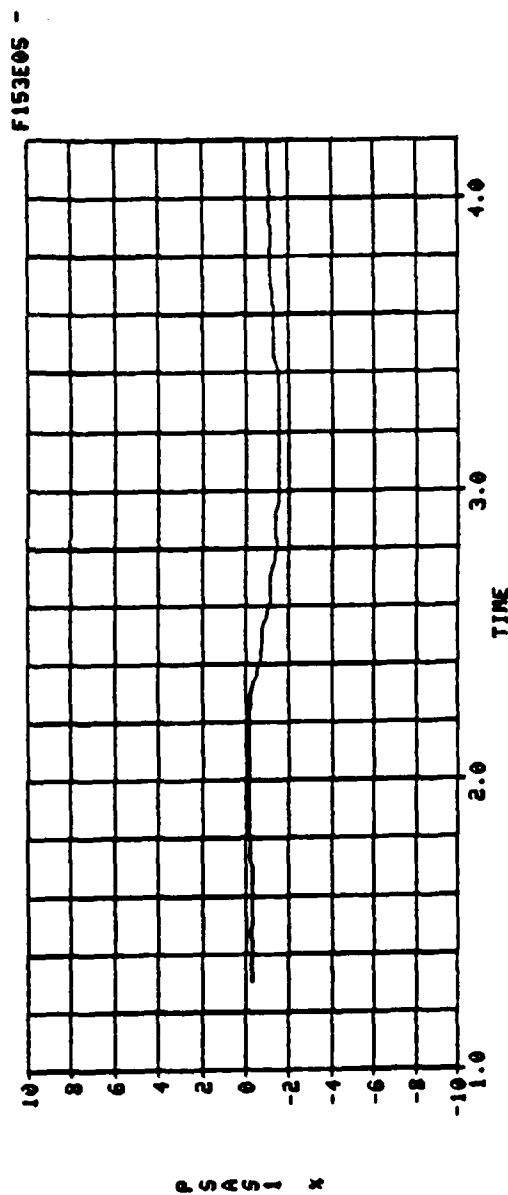
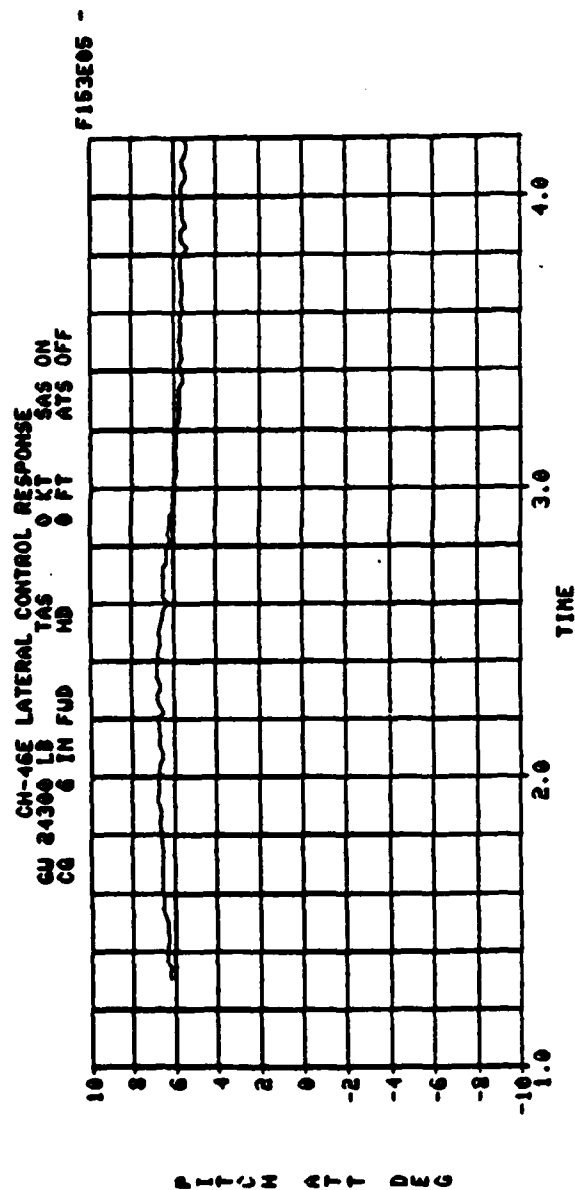


FIGURE 9G

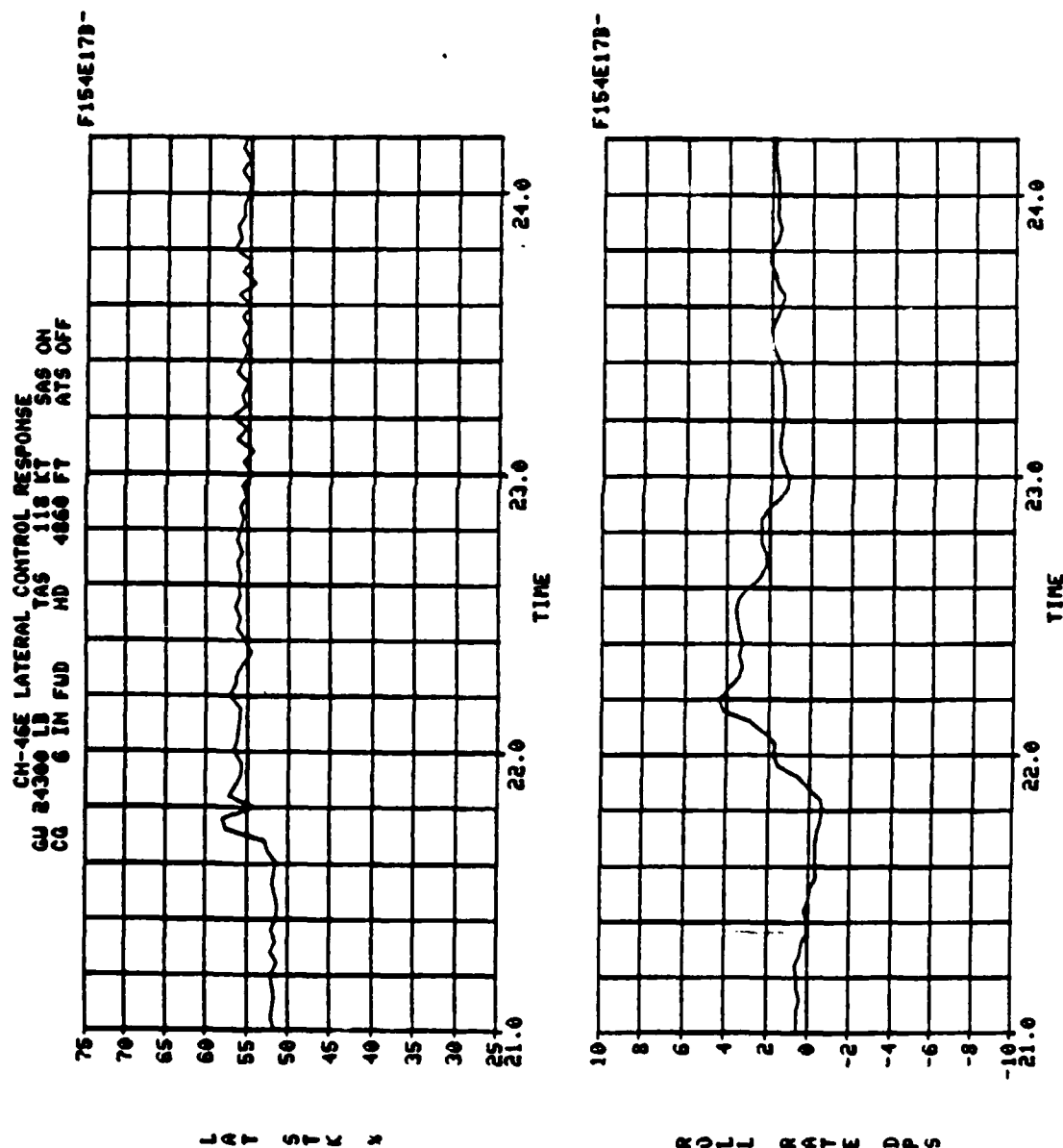


FIGURE 10A



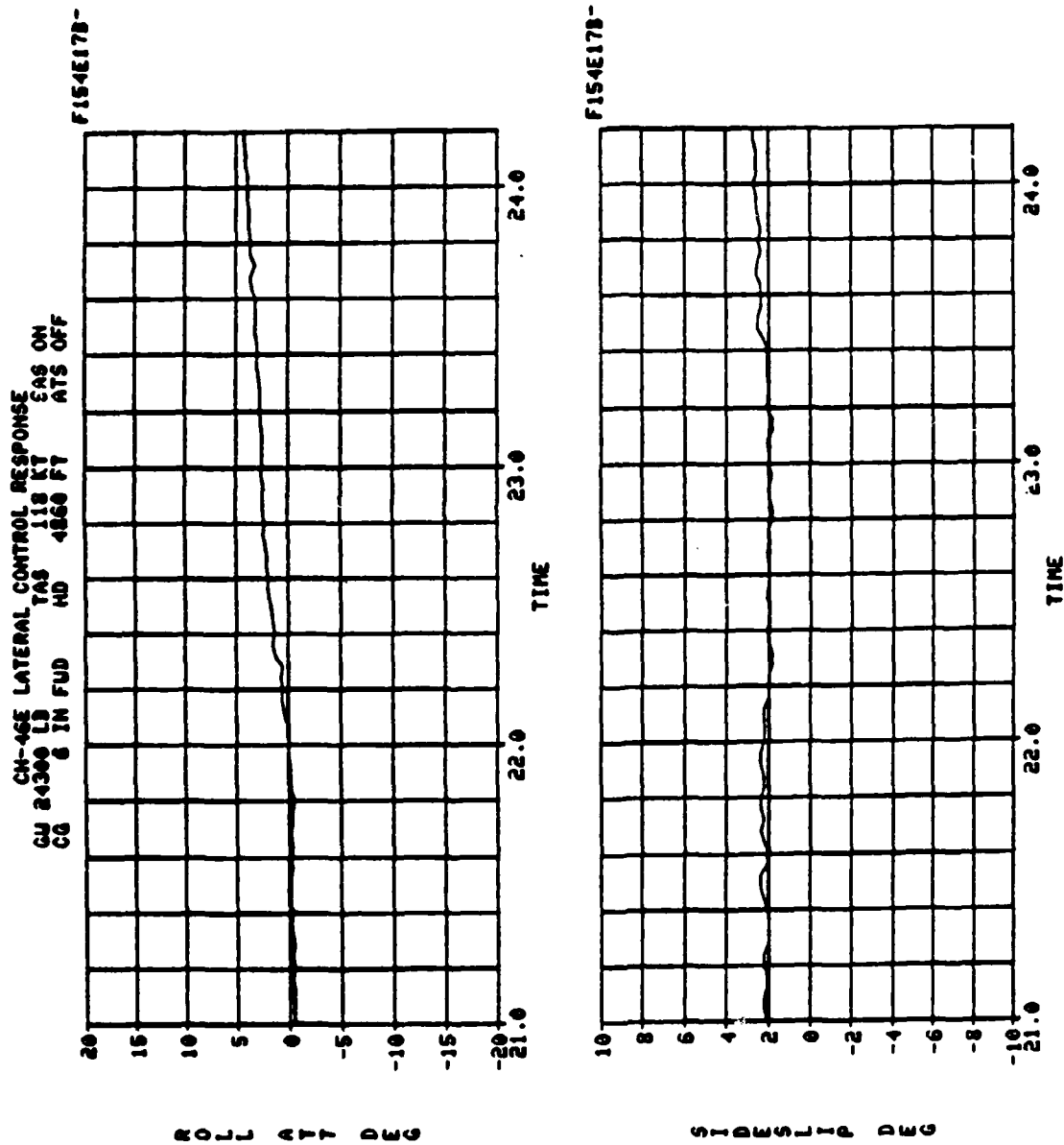


FIGURE 10B

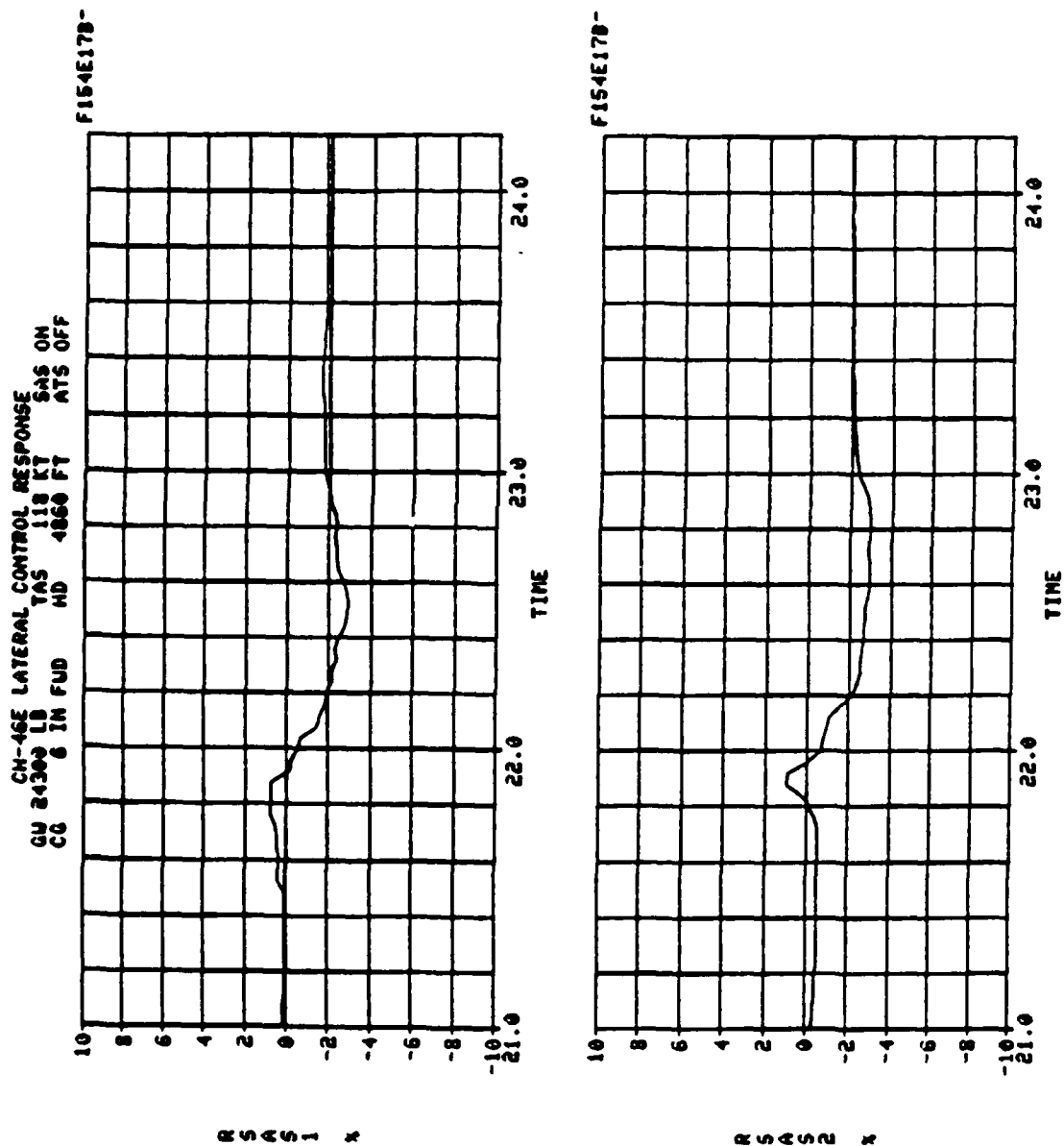


FIGURE 10C

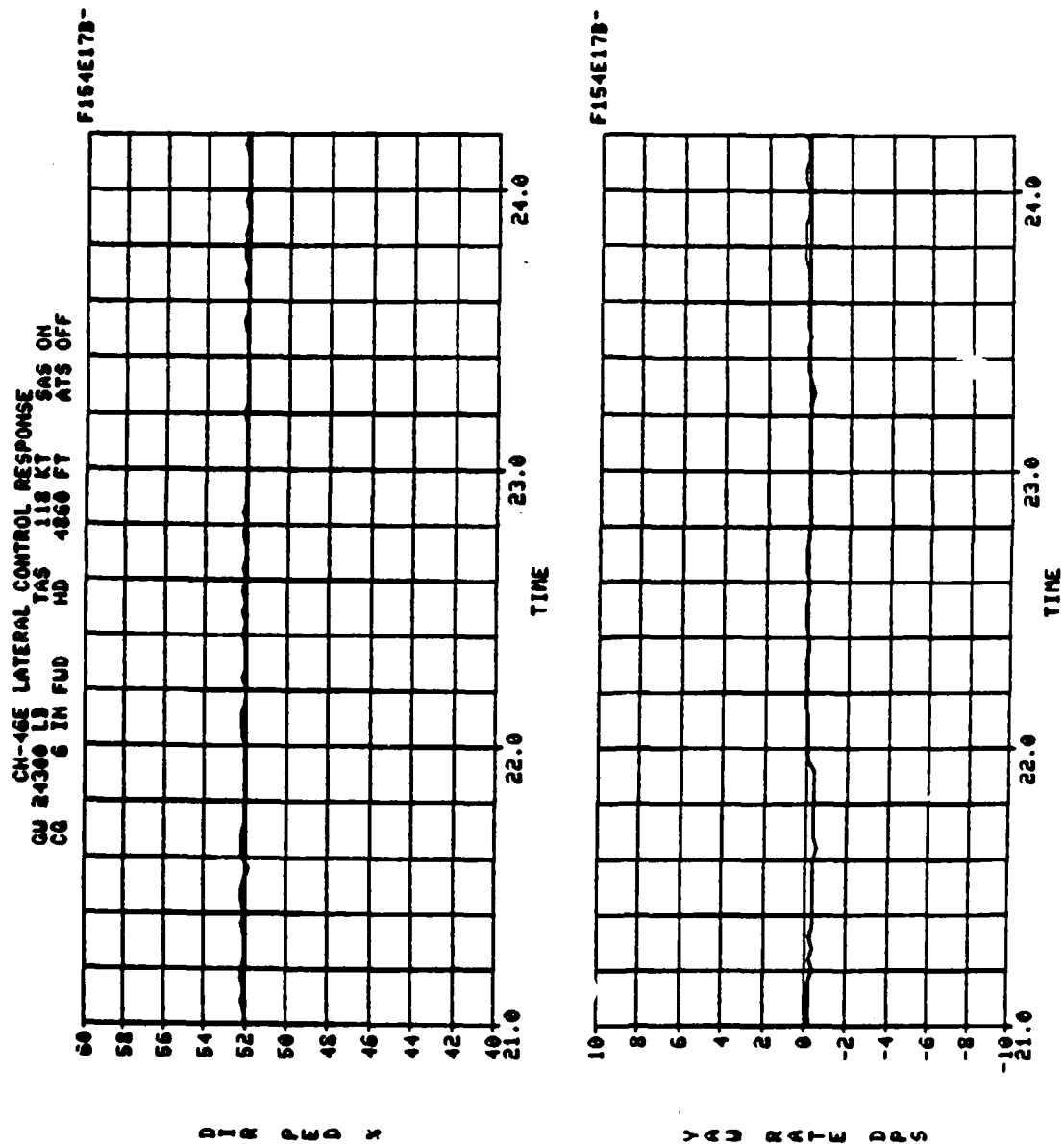


FIGURE 10D

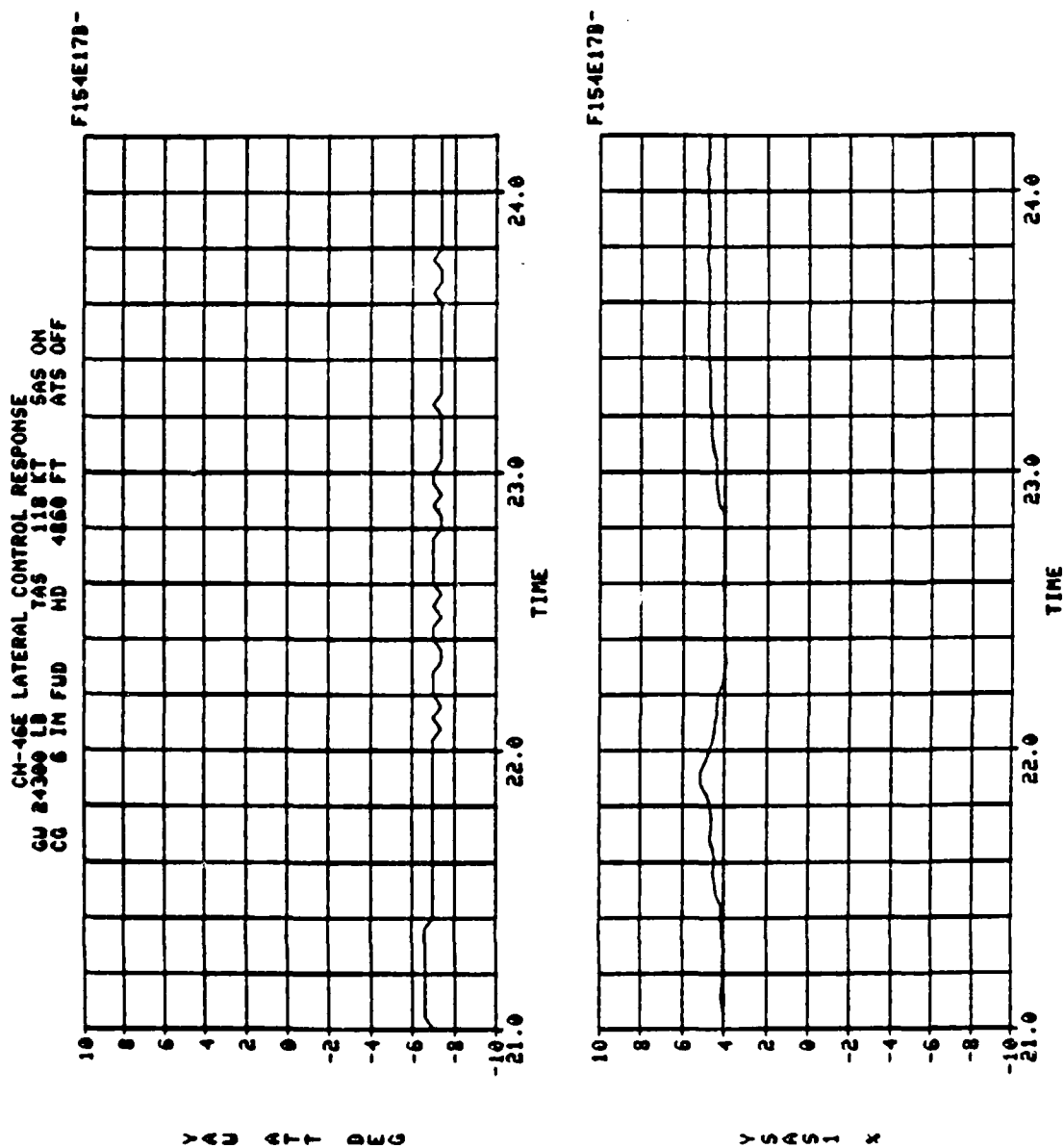


FIGURE 10E

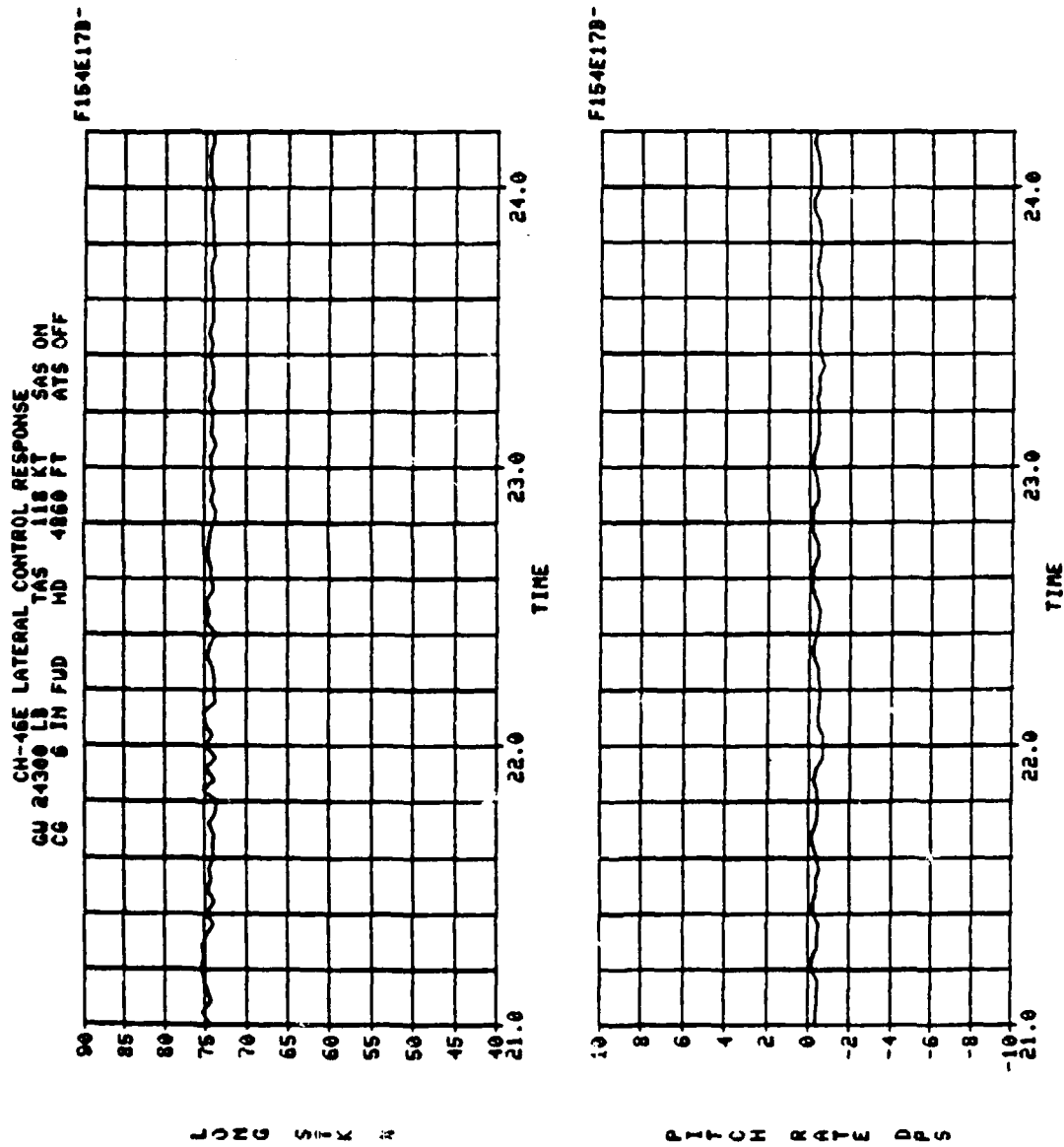


FIGURE 10F

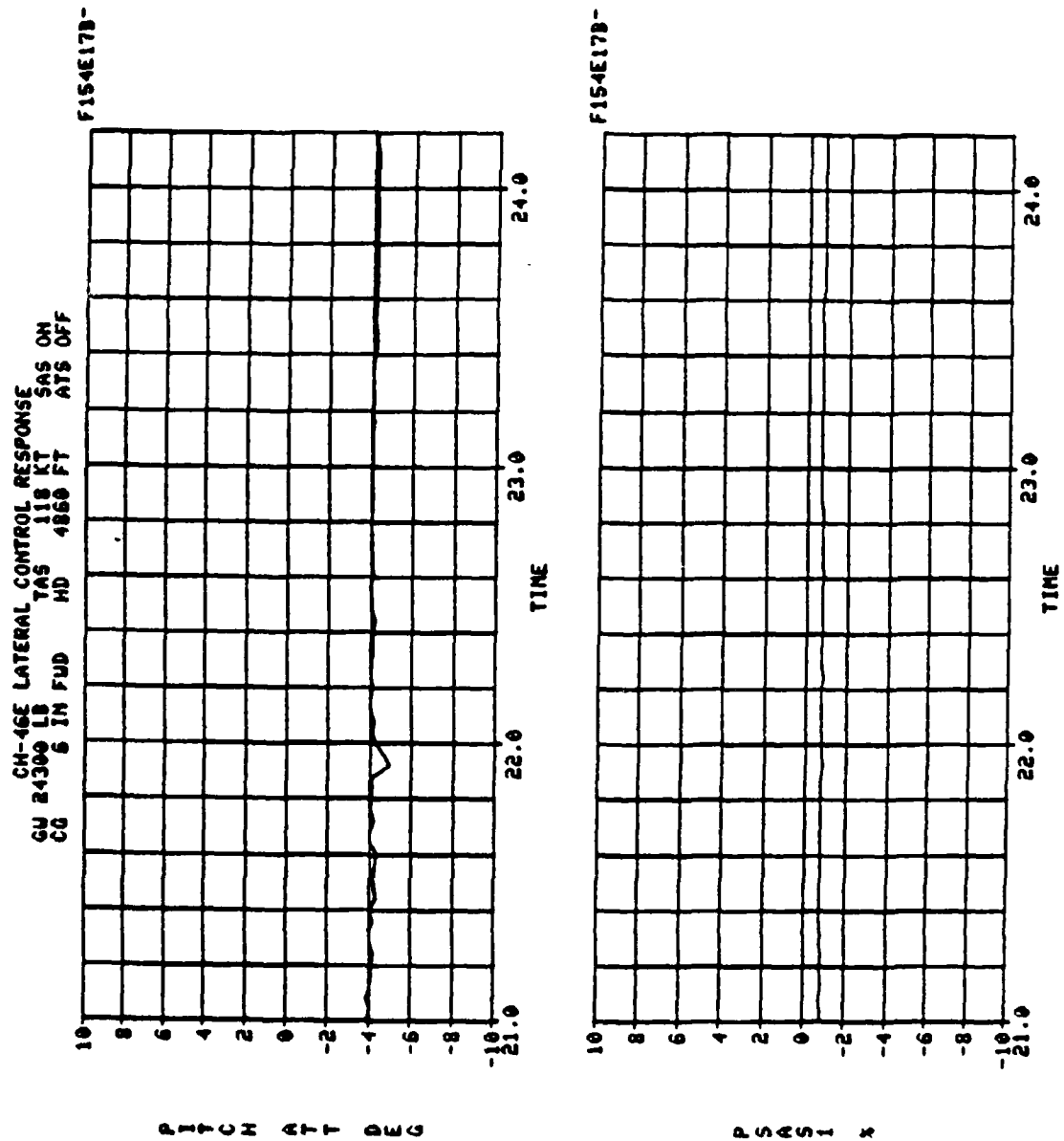


FIGURE 10G

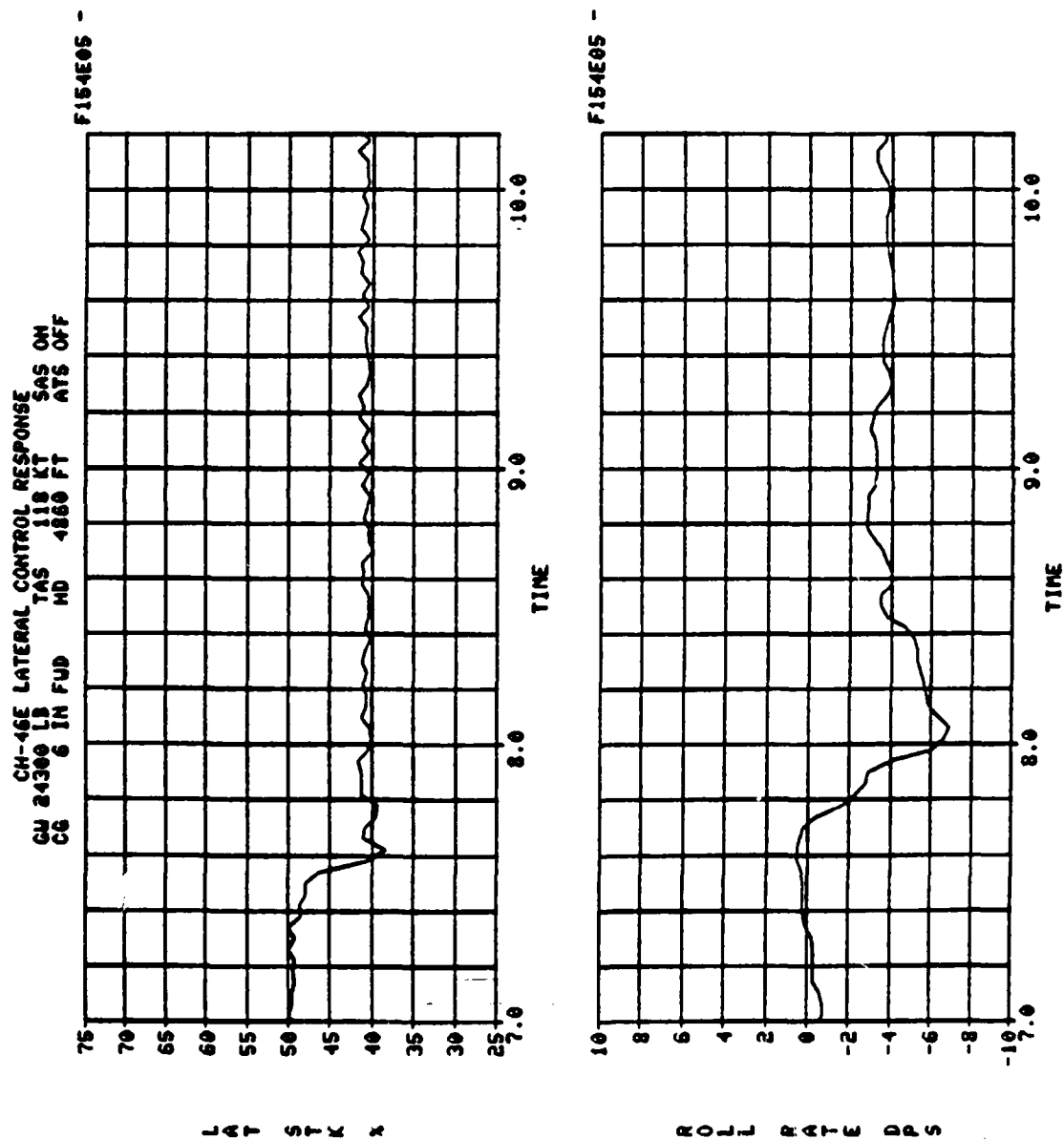


FIGURE 11A

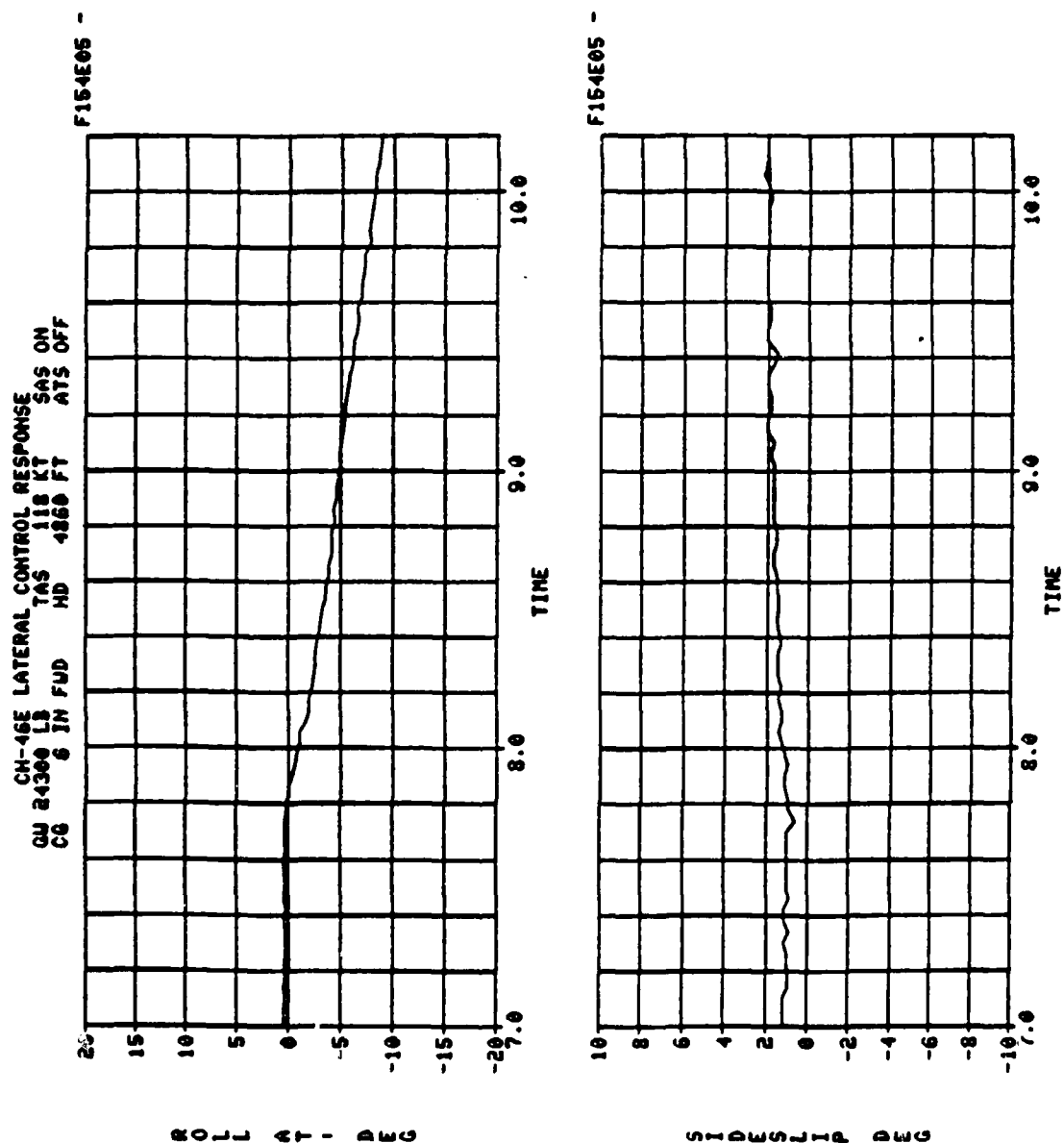


FIGURE 11B



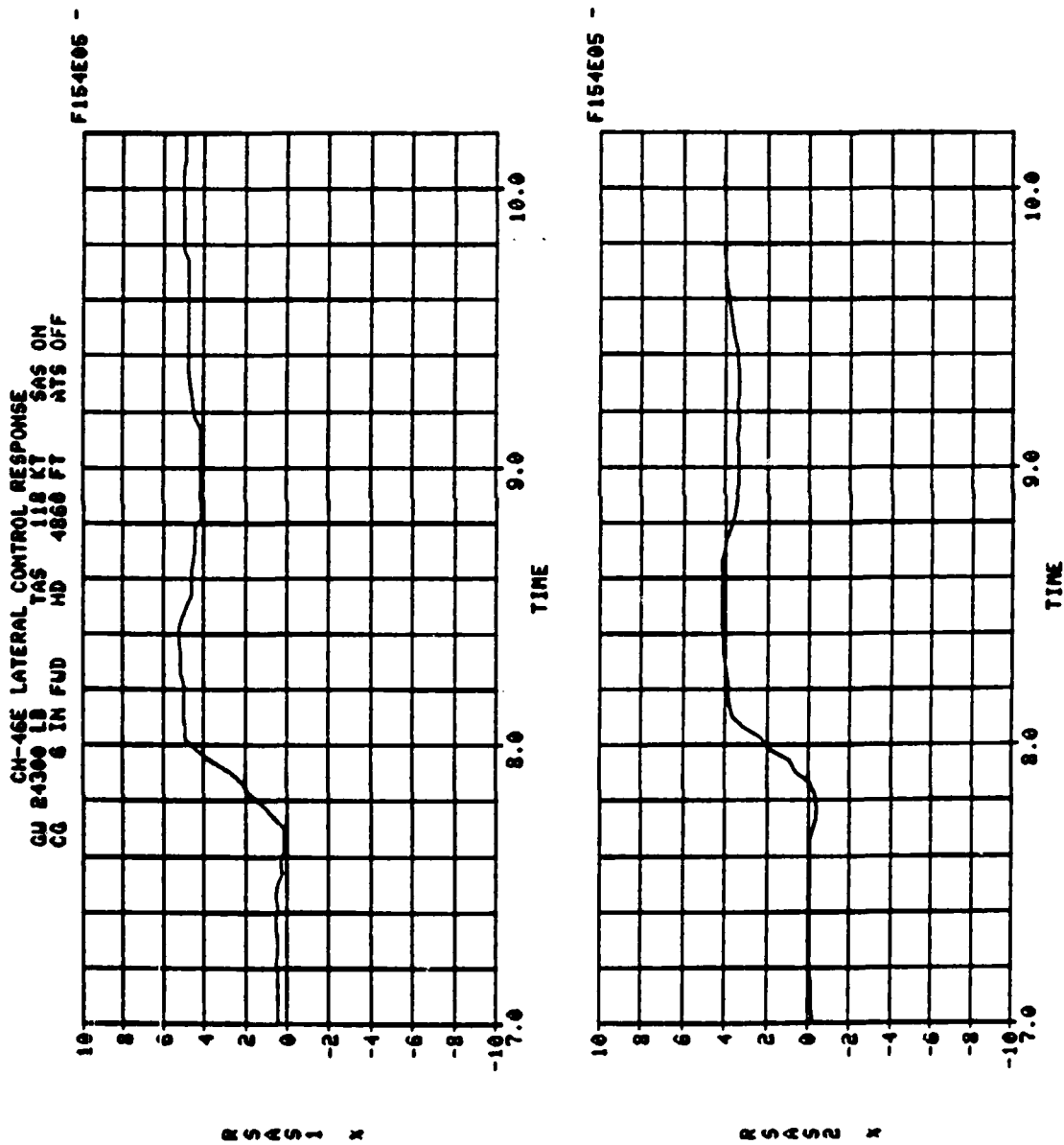


FIGURE 11C

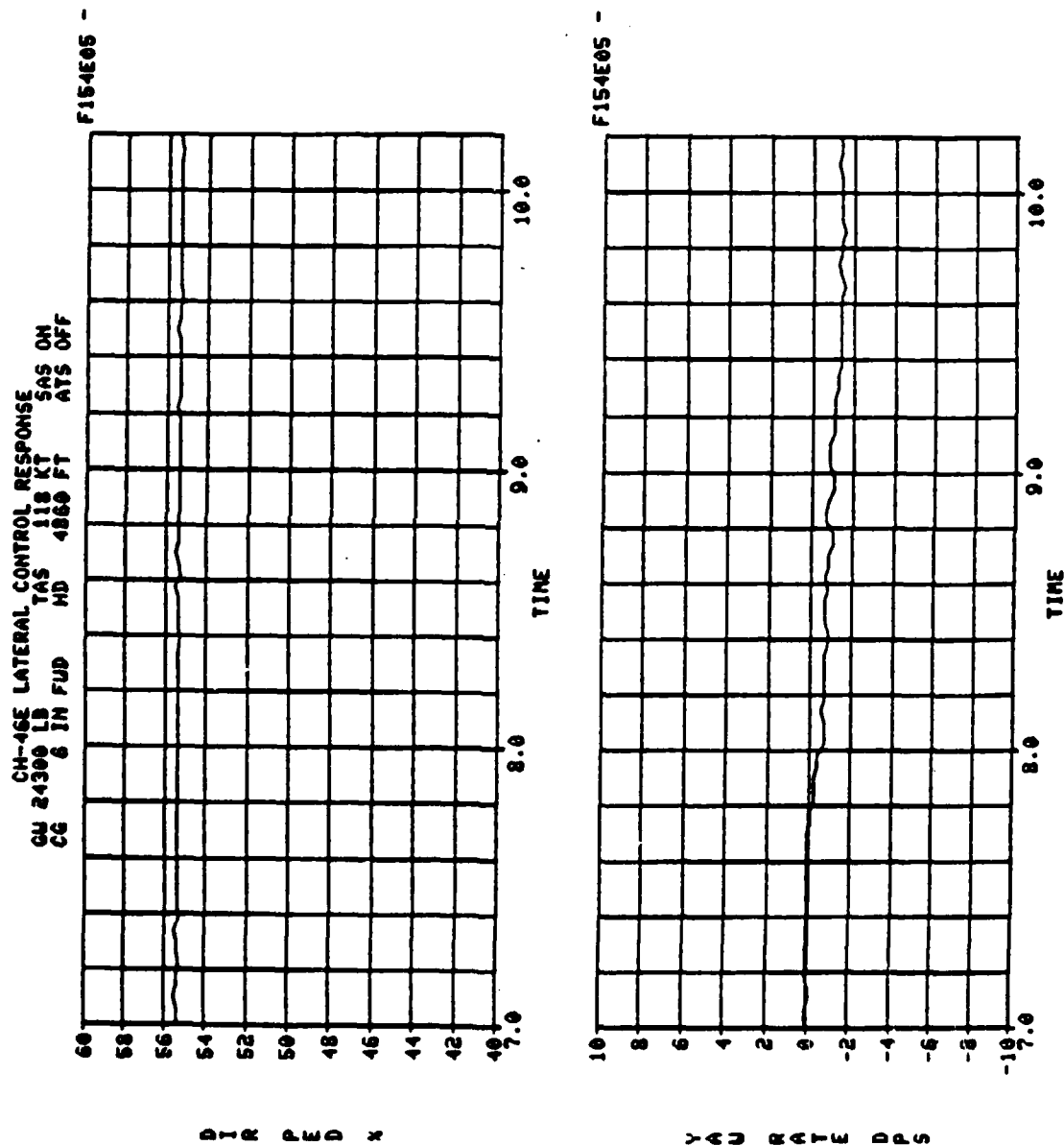


FIGURE 11D

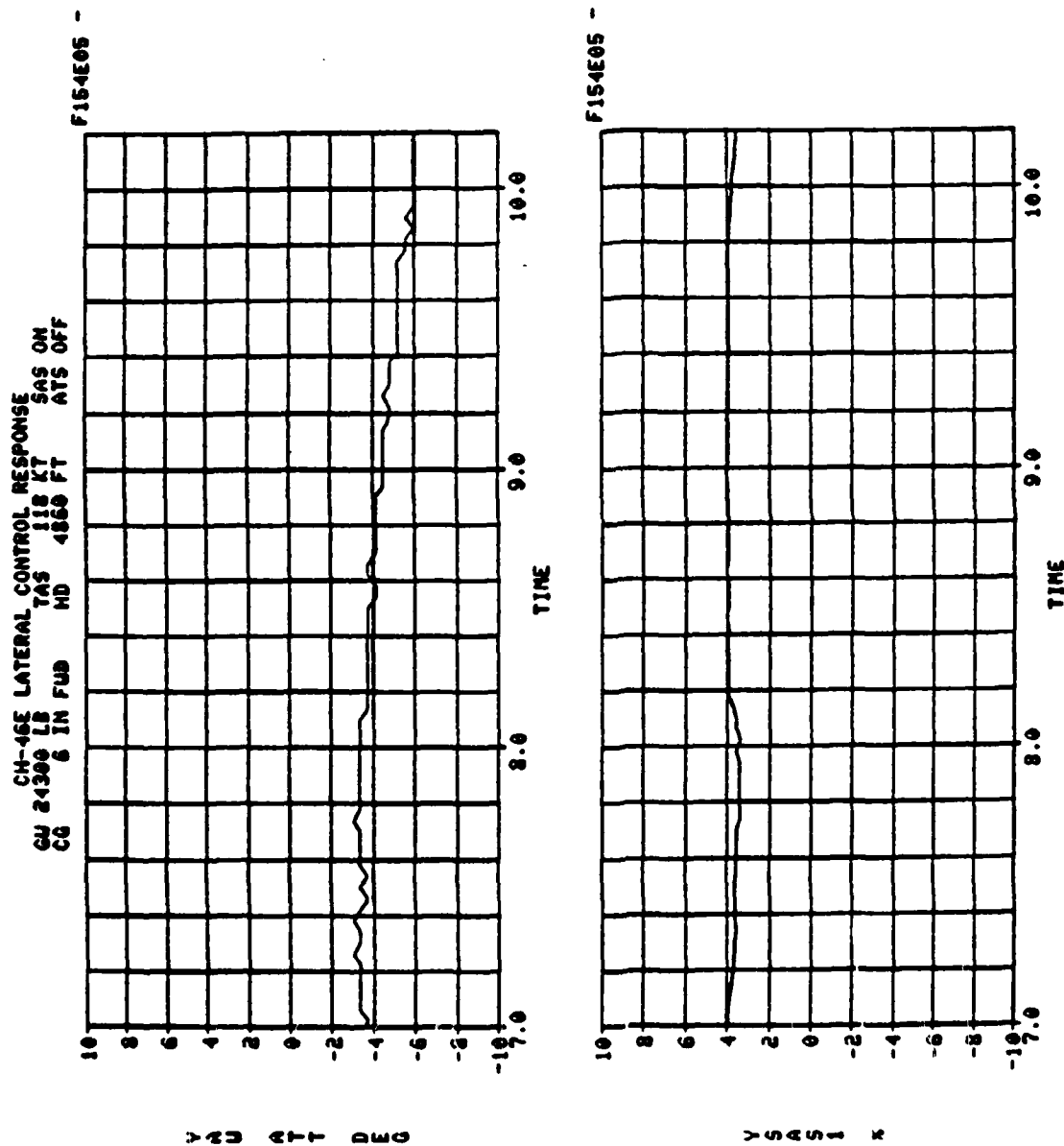


FIGURE 11E

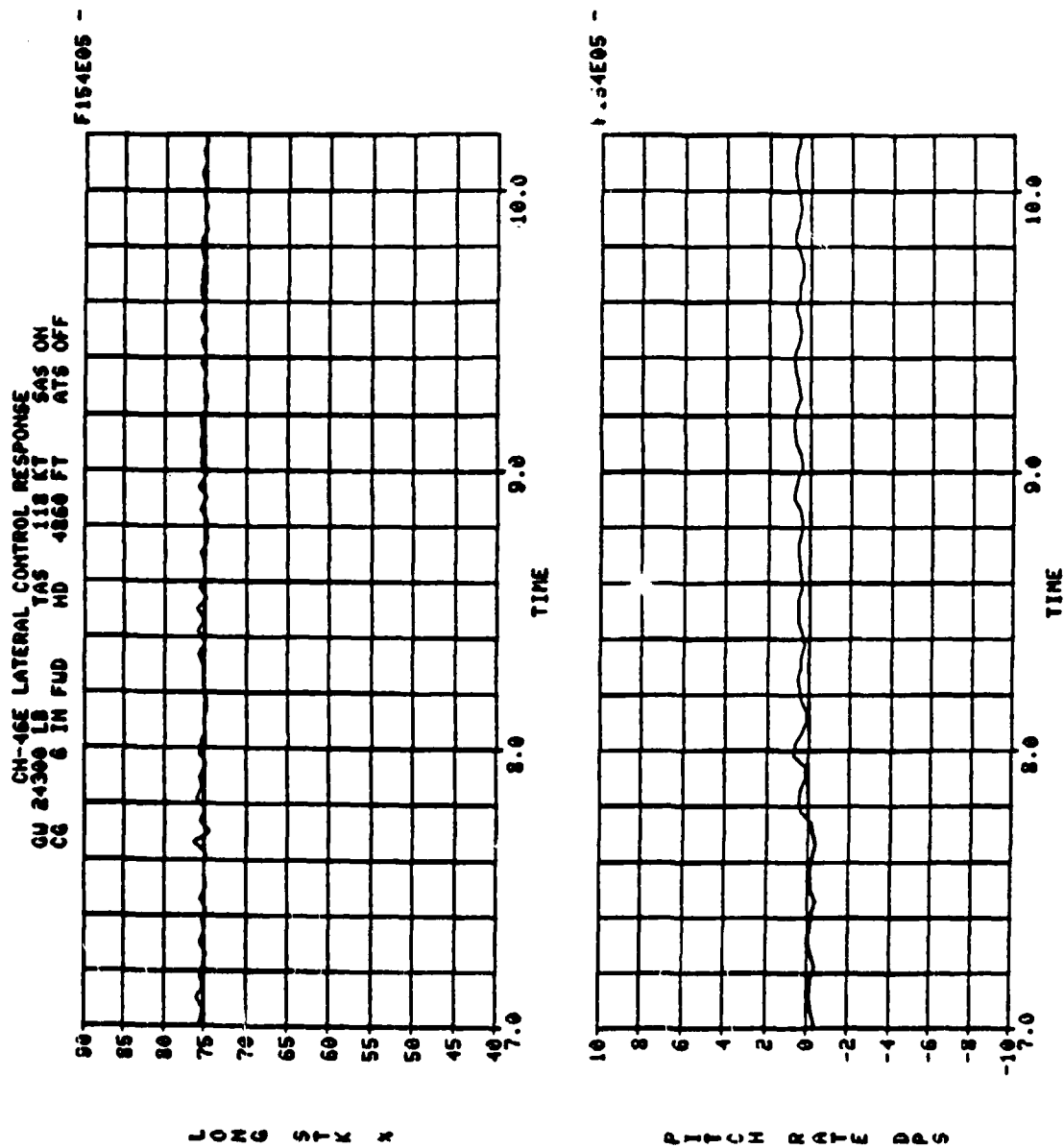


FIGURE 11F

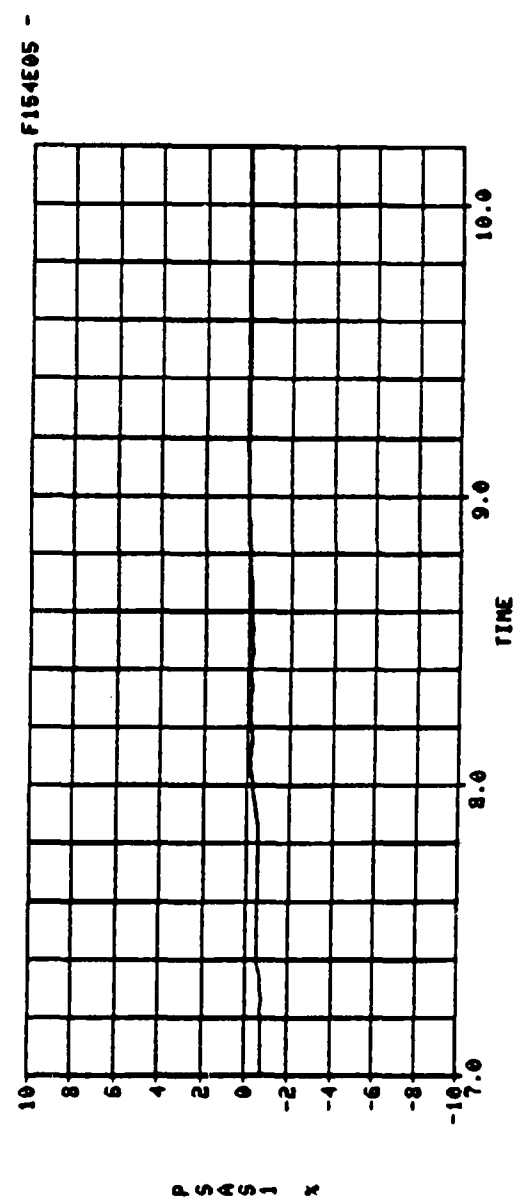
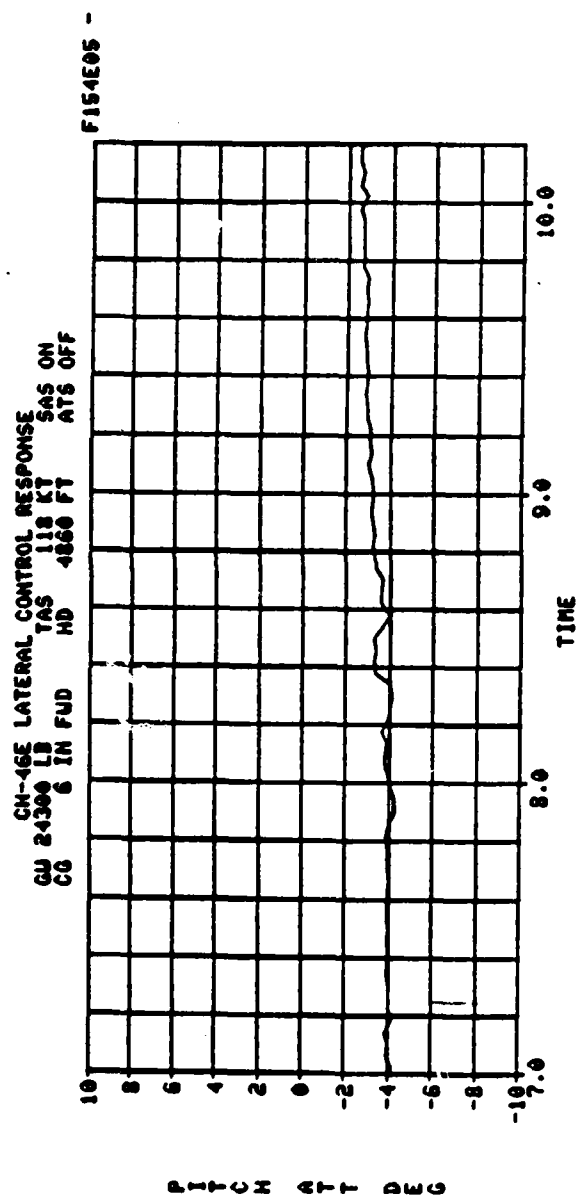


FIGURE 11G

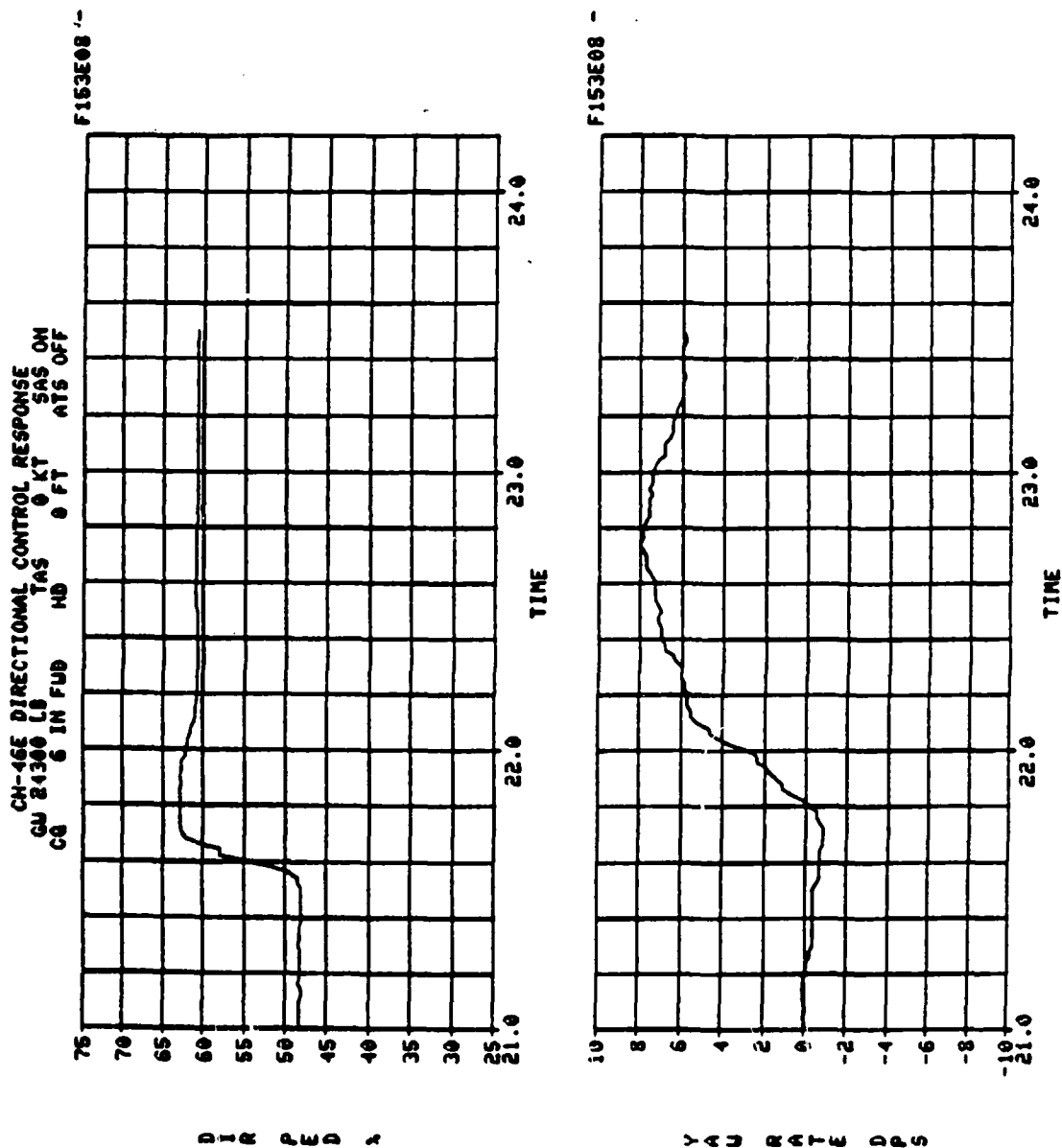


FIGURE 12A

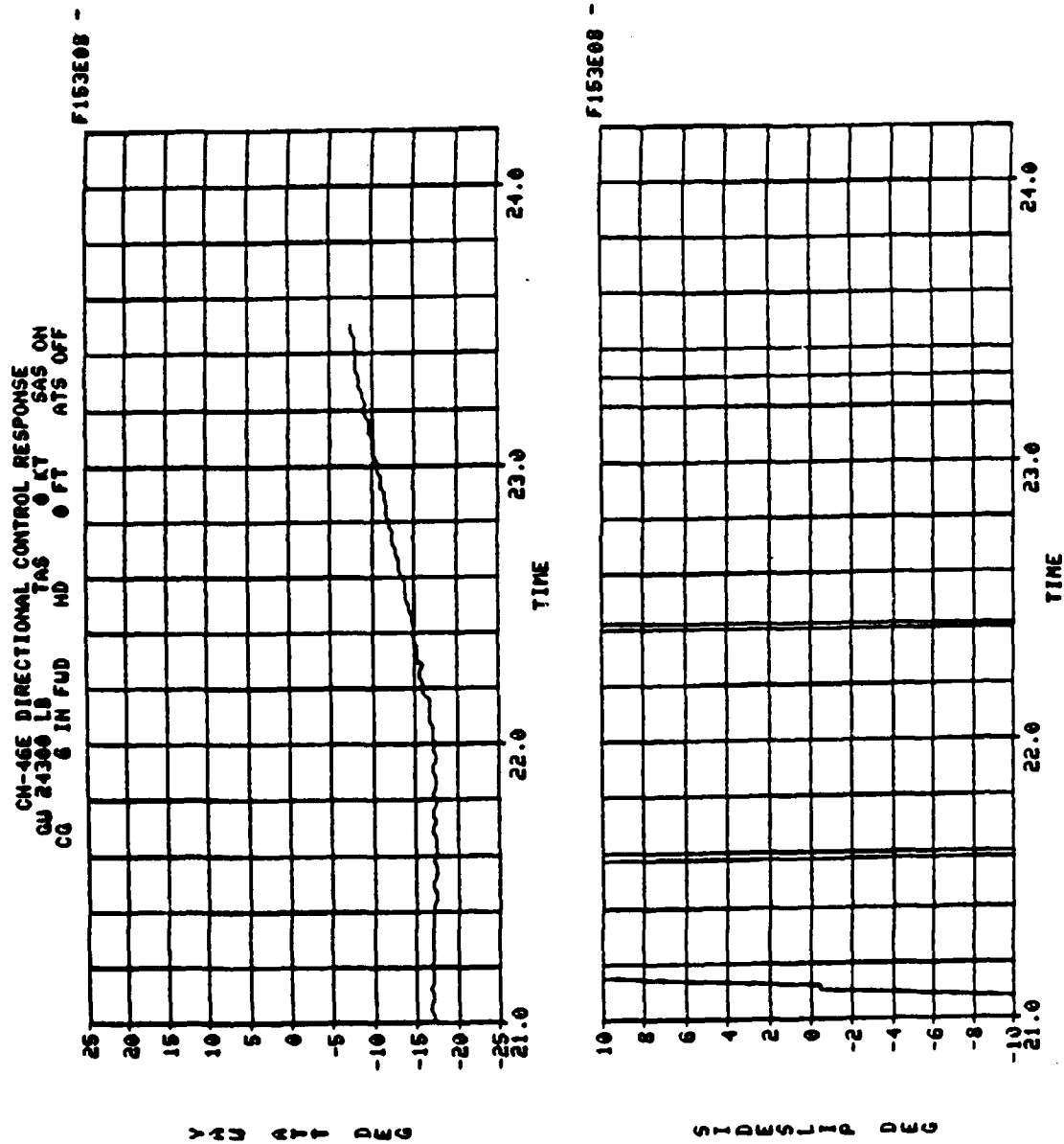


FIGURE 12B

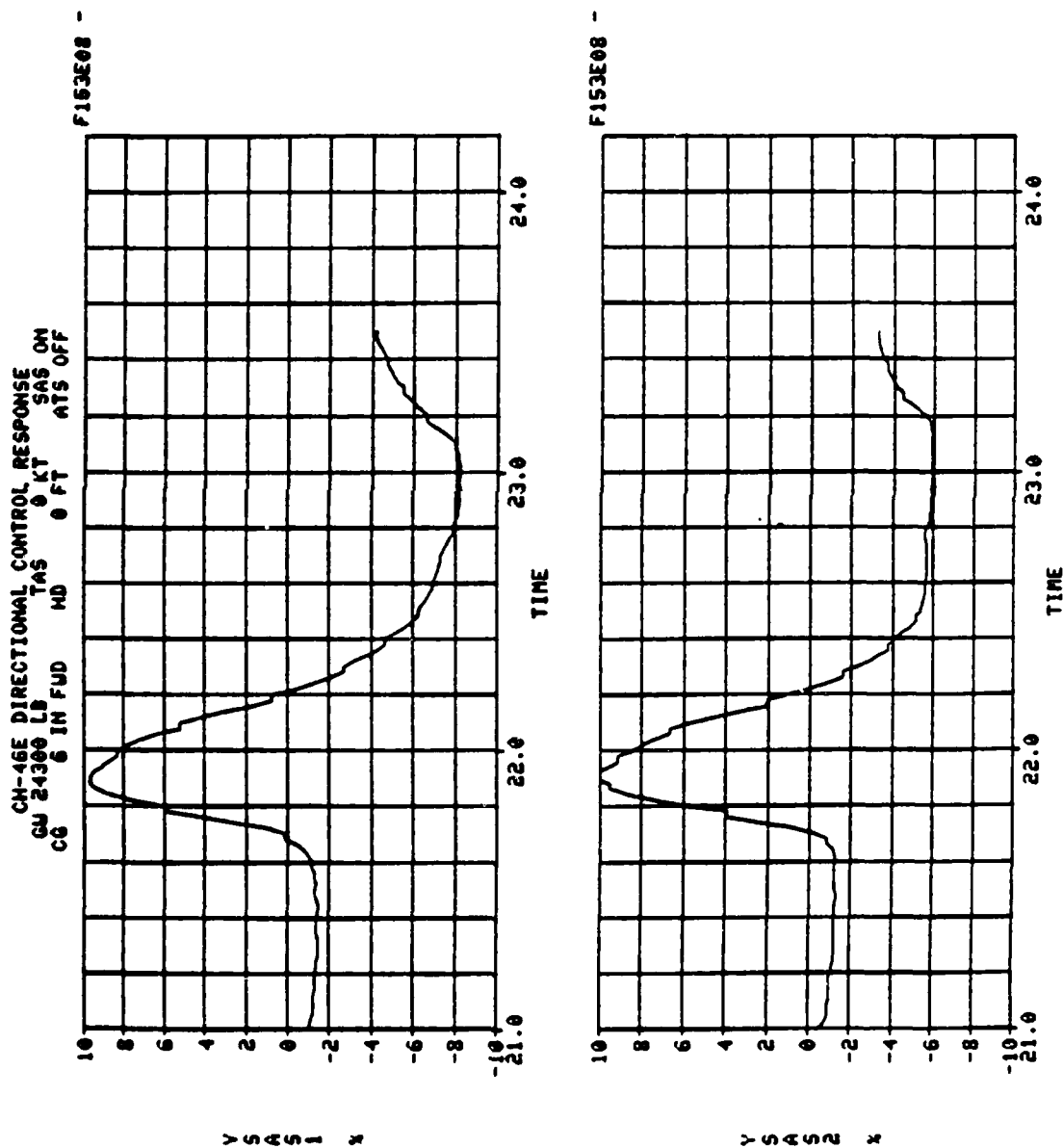


FIGURE 12C



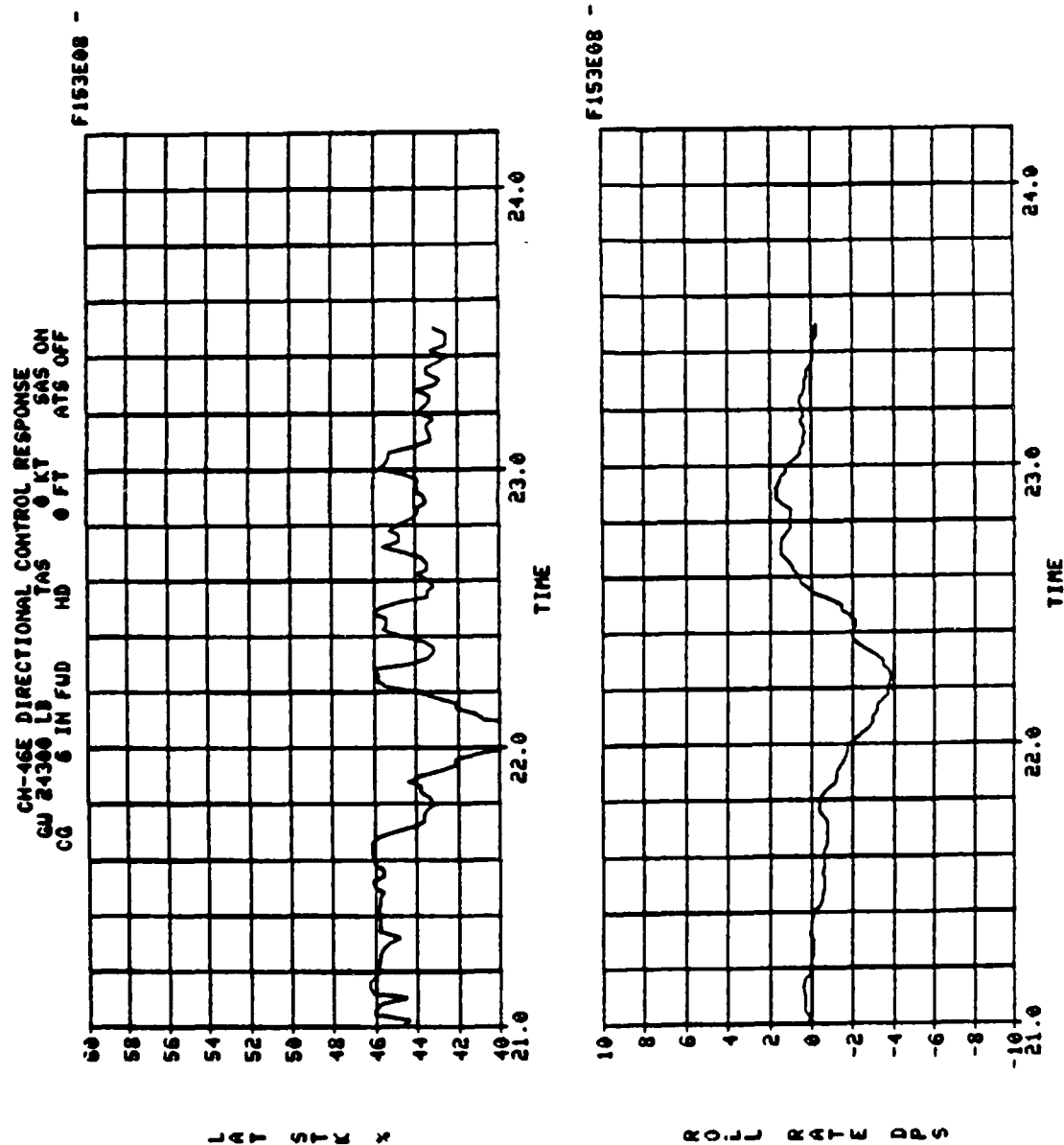


FIGURE 12D

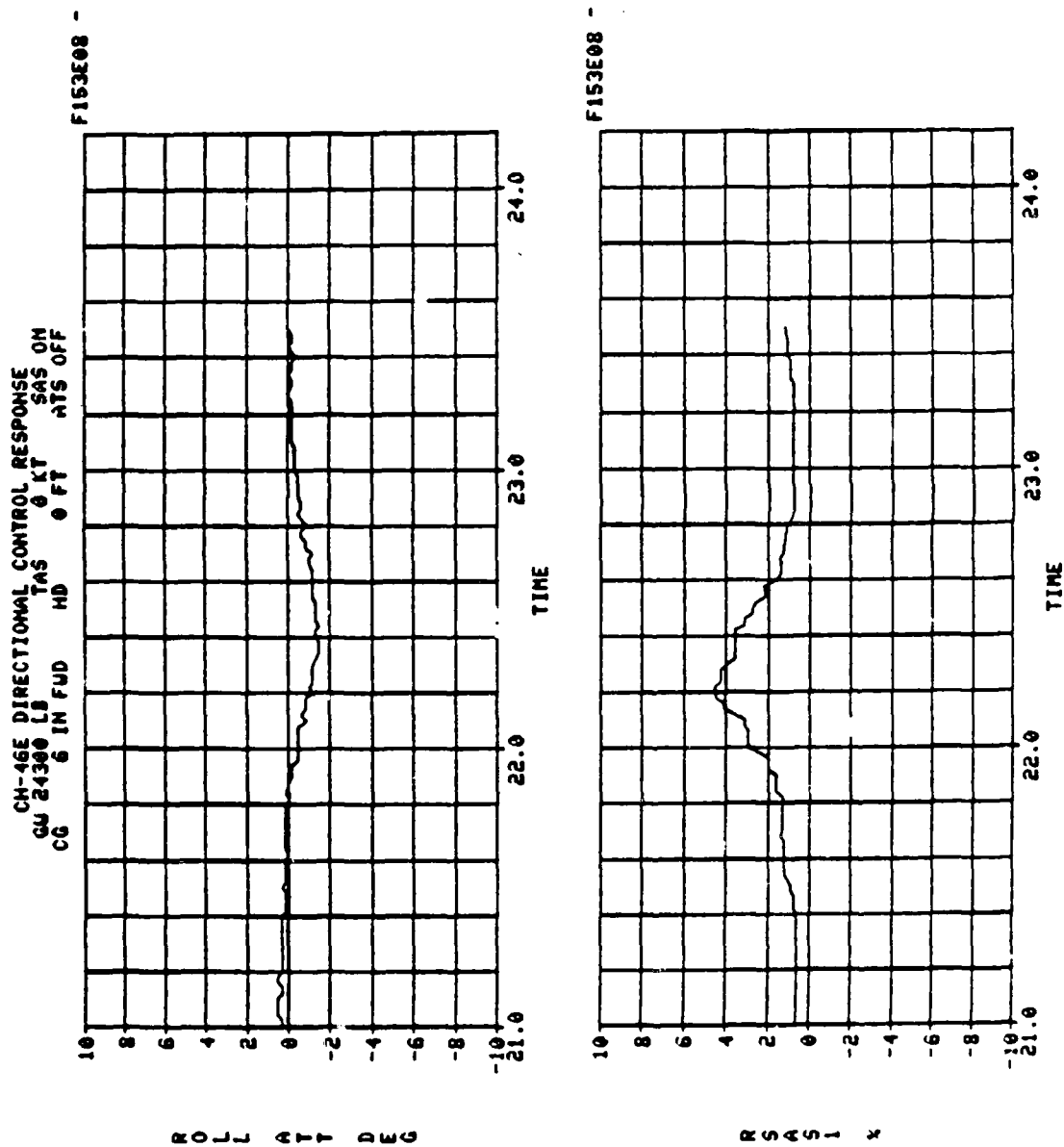


FIGURE 12E

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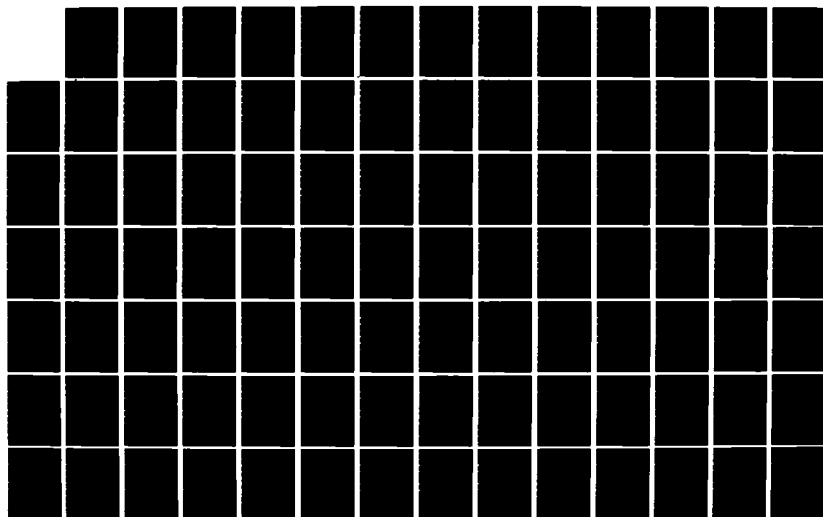
HELICOPTER FLYING QUALITIES CHARACTERISTICS-CH-46E  
VOLUME 3(U) BOEING VERTOL CO PHILADELPHIA PA 03 OCT 83  
NADC-81118-60-VOL-3

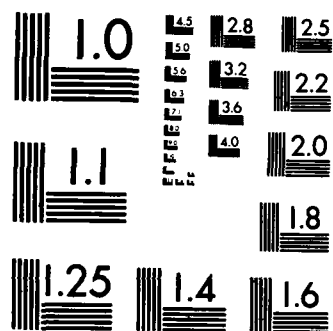
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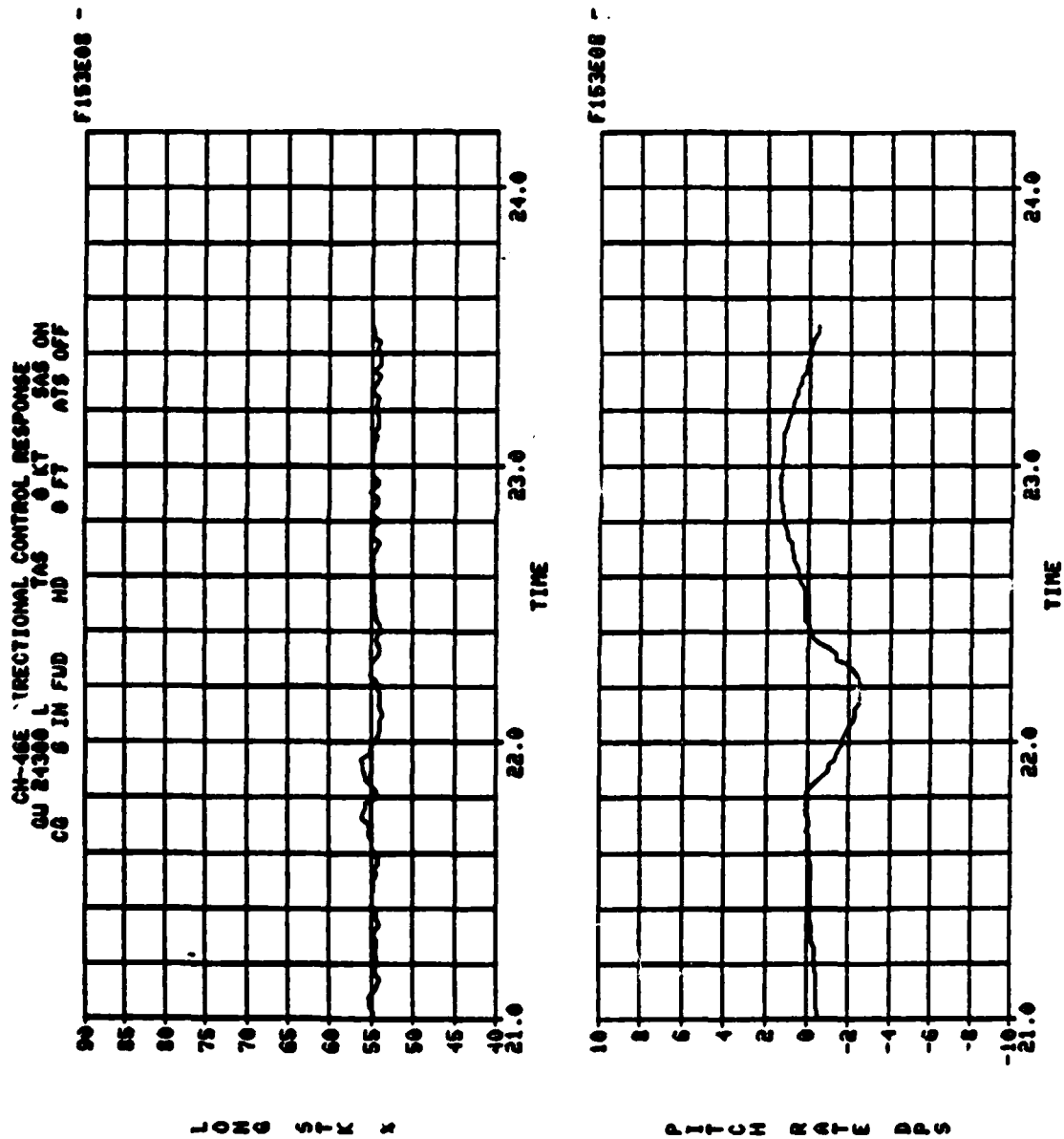


FIGURE 12F

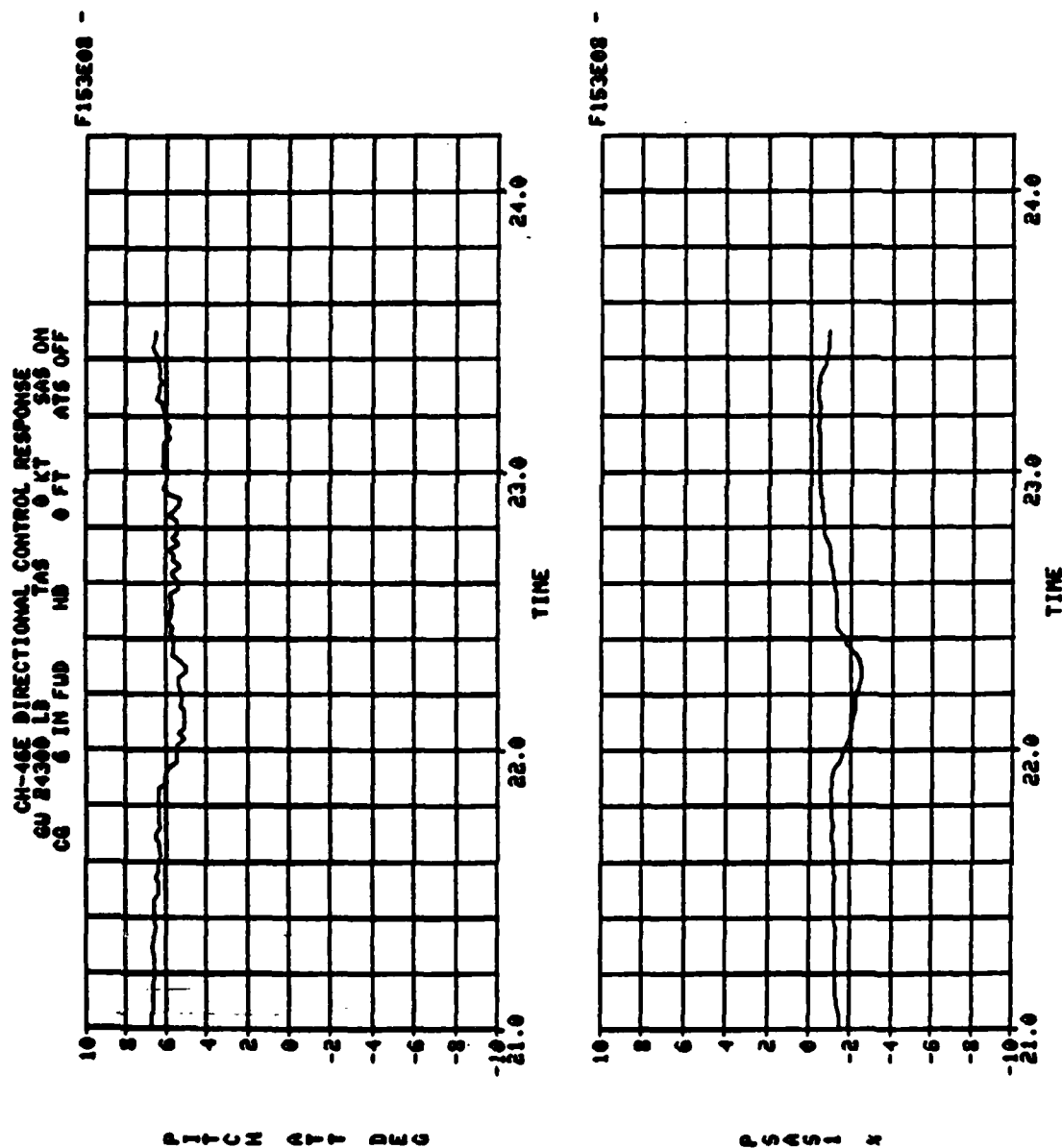


FIGURE 12G

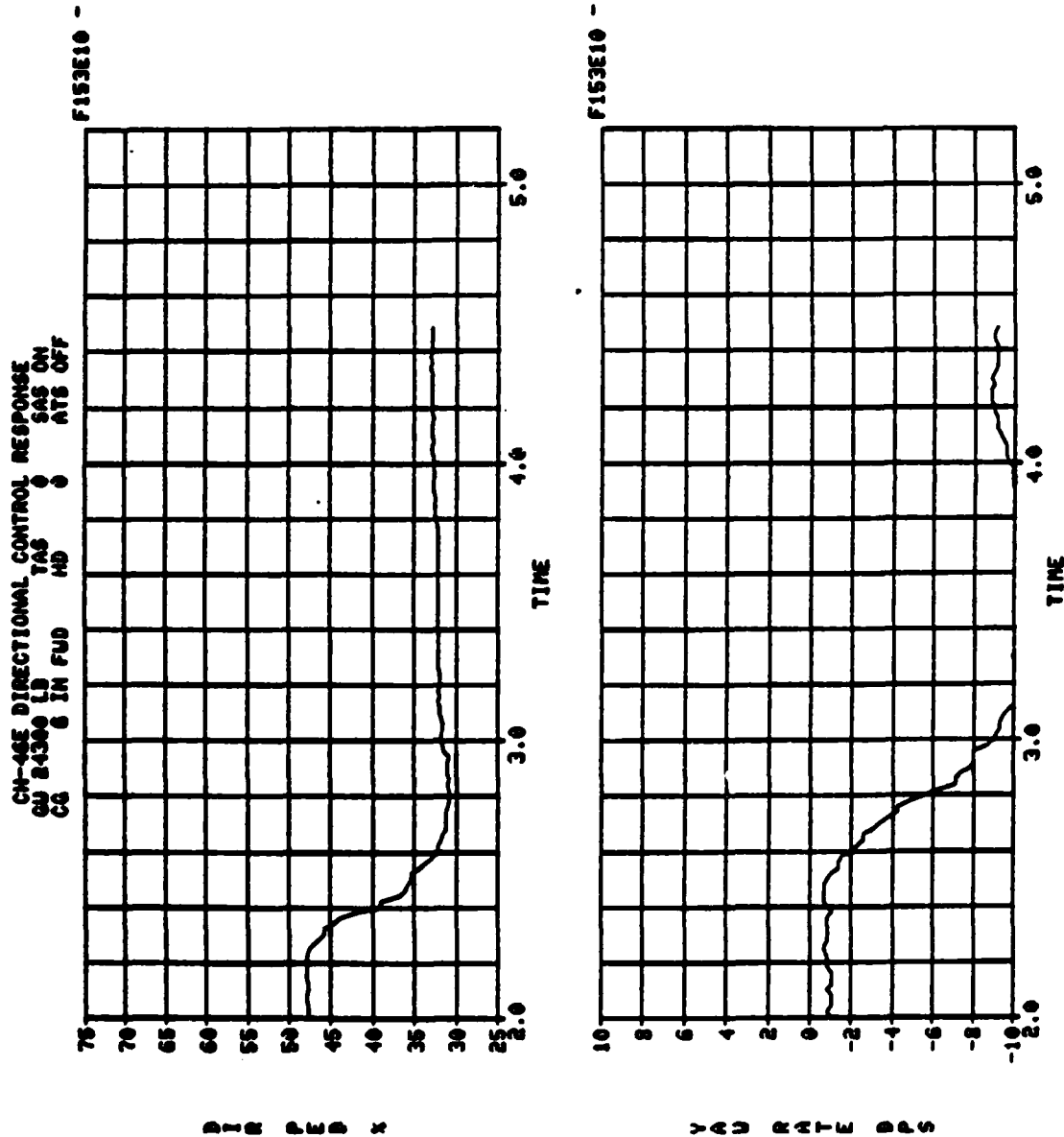


FIGURE 13A

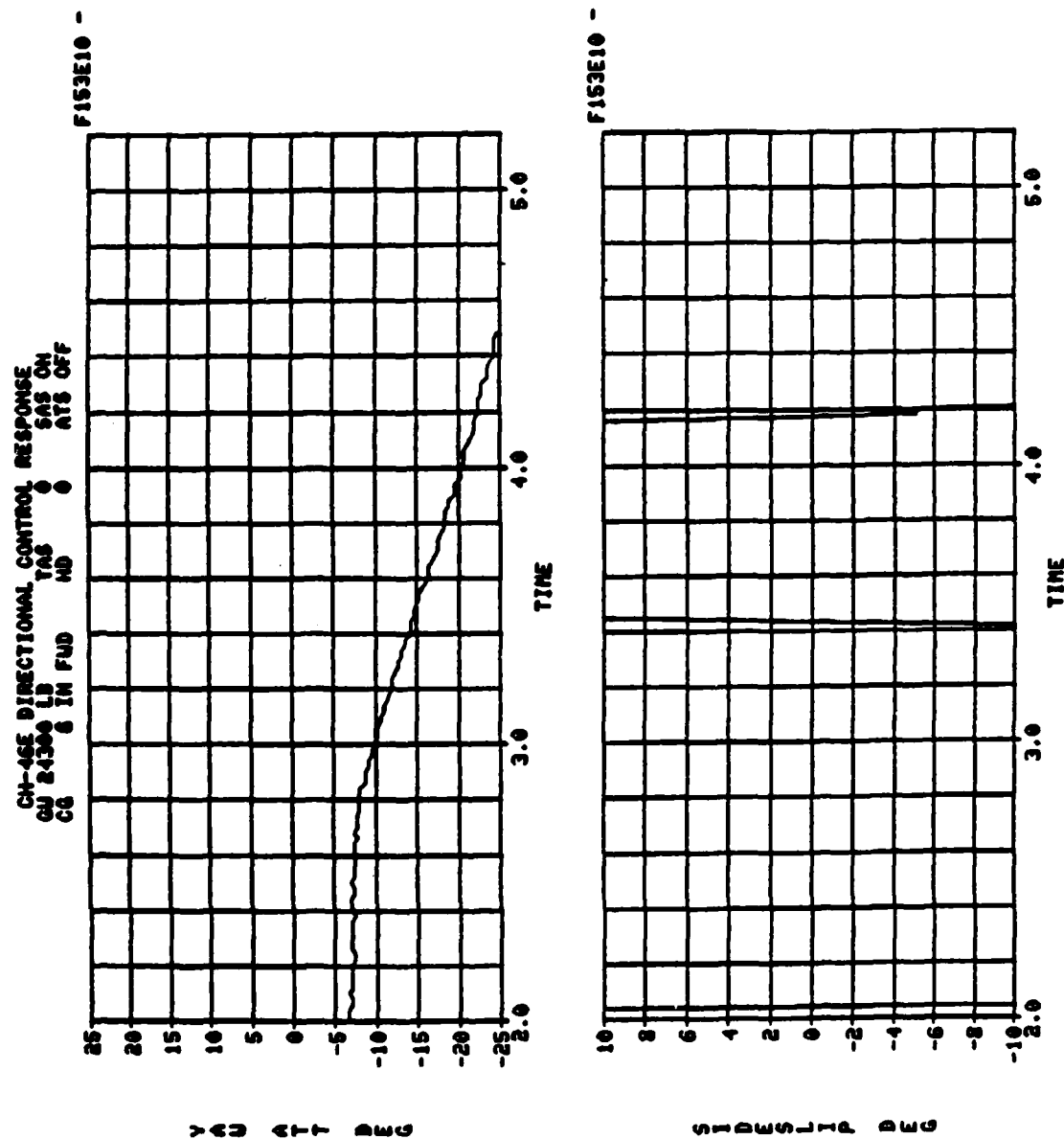


FIGURE 13B



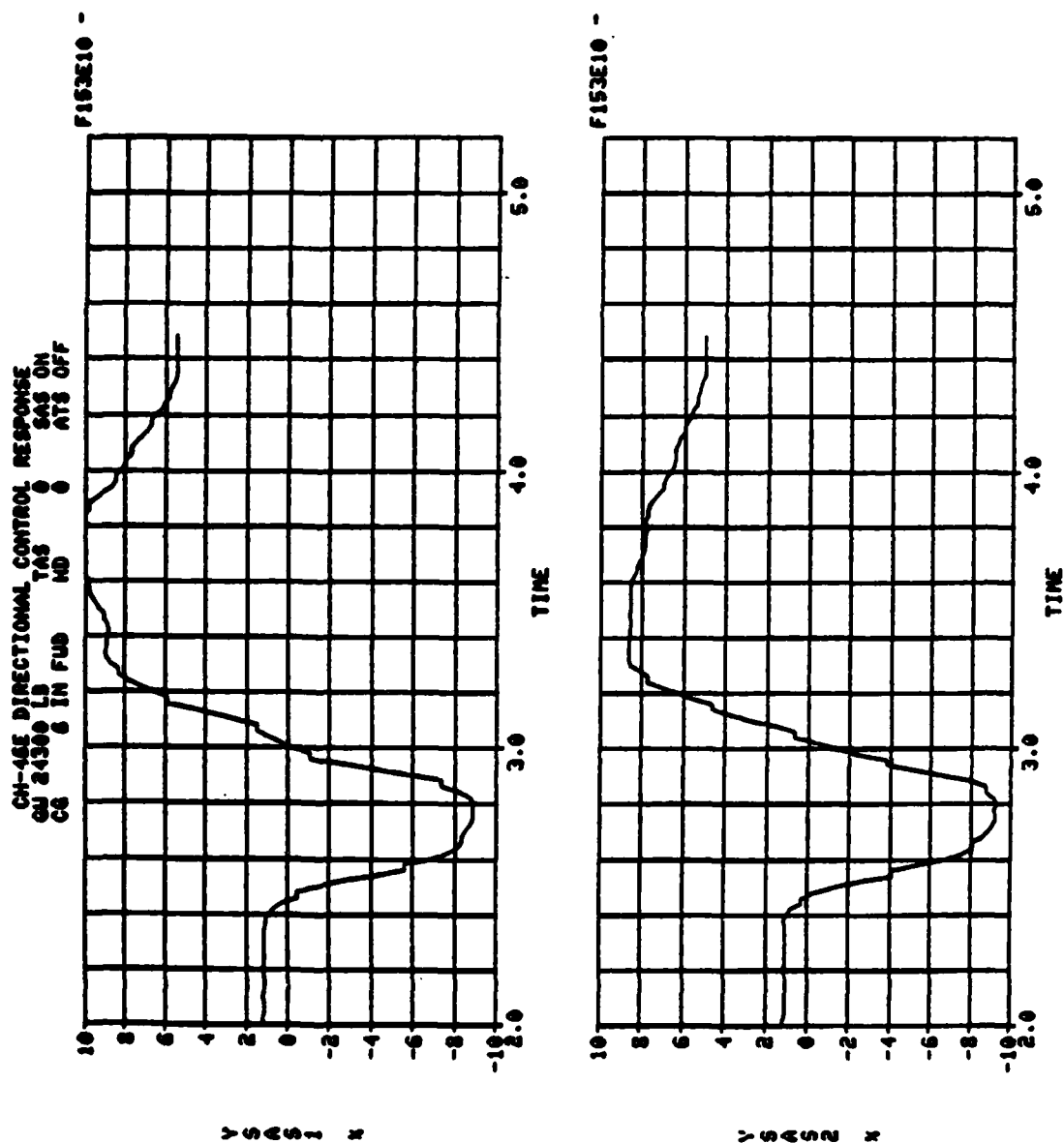


FIGURE 13C

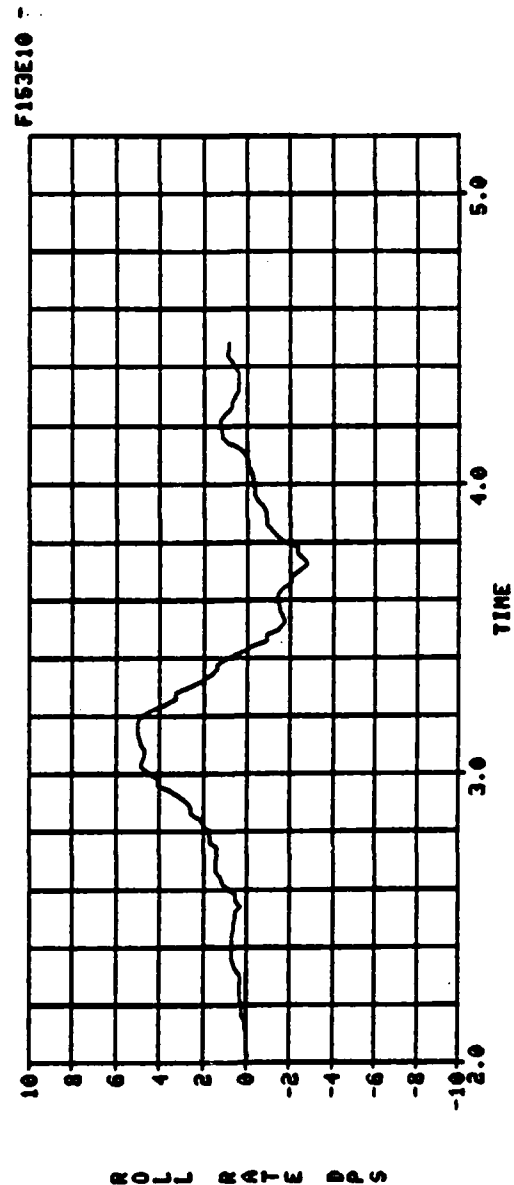
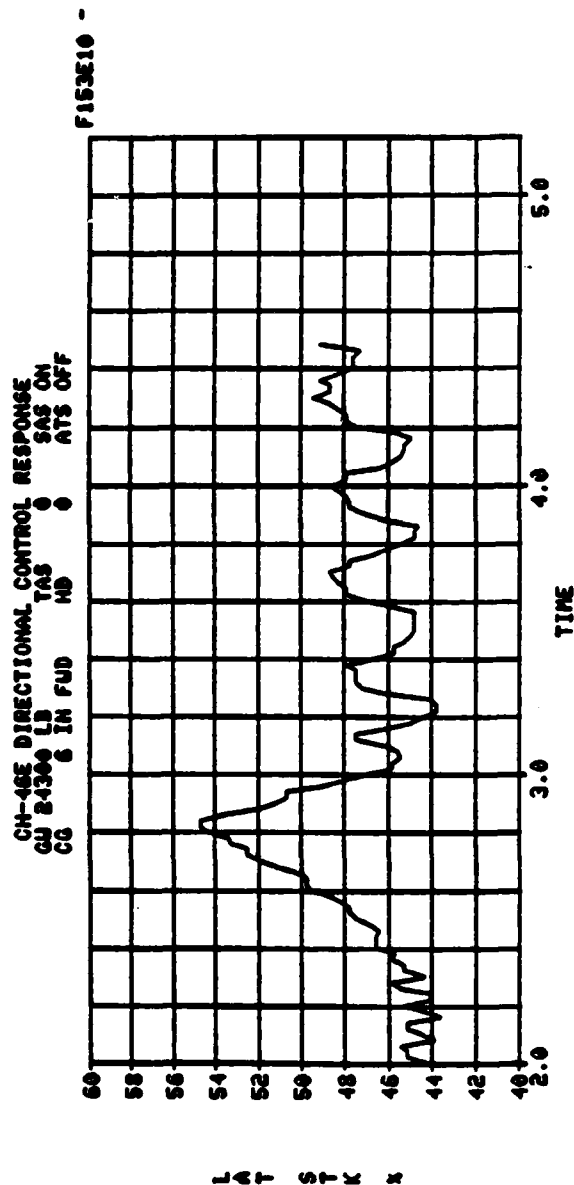


FIGURE 13D

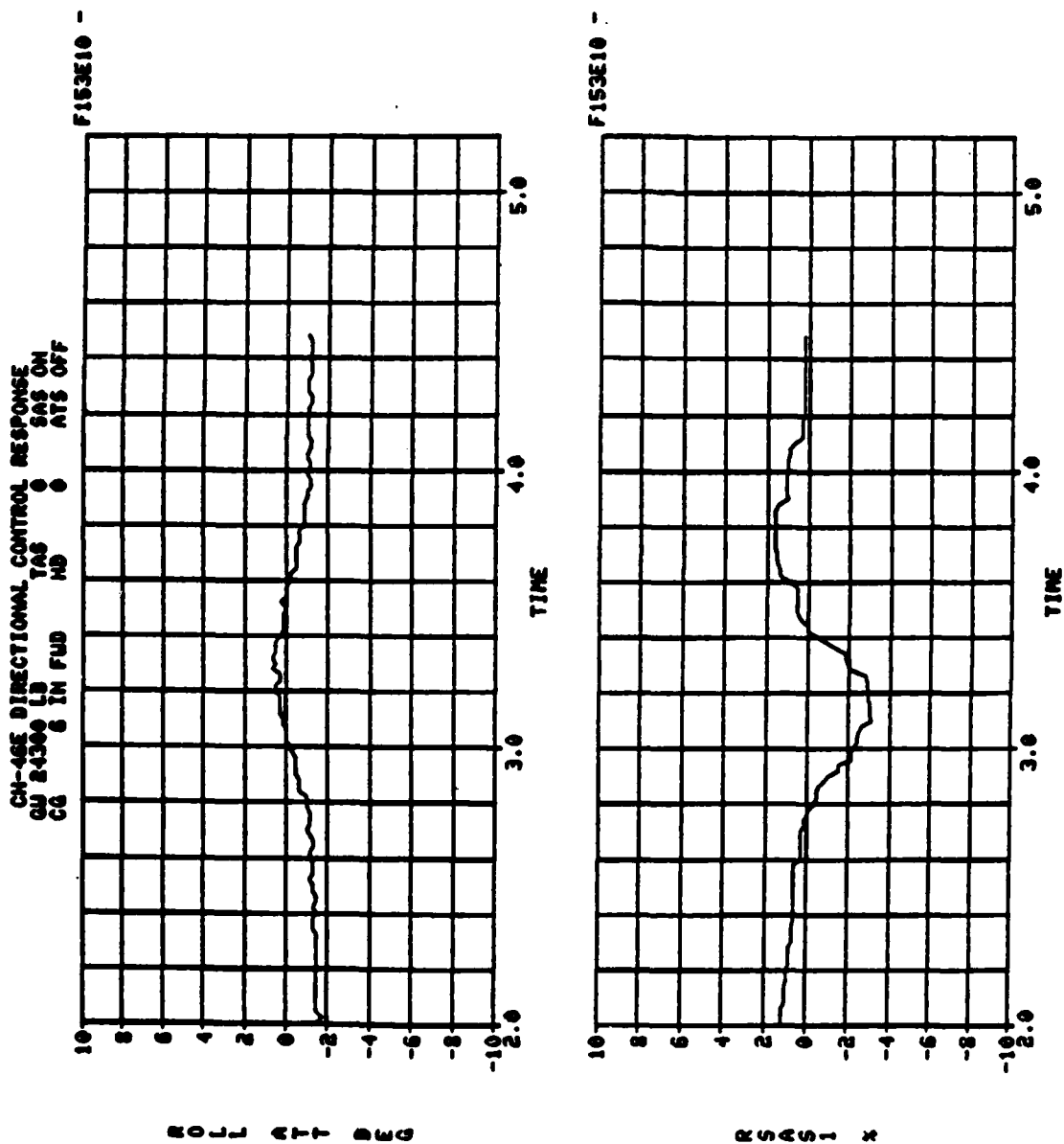


FIGURE 13E

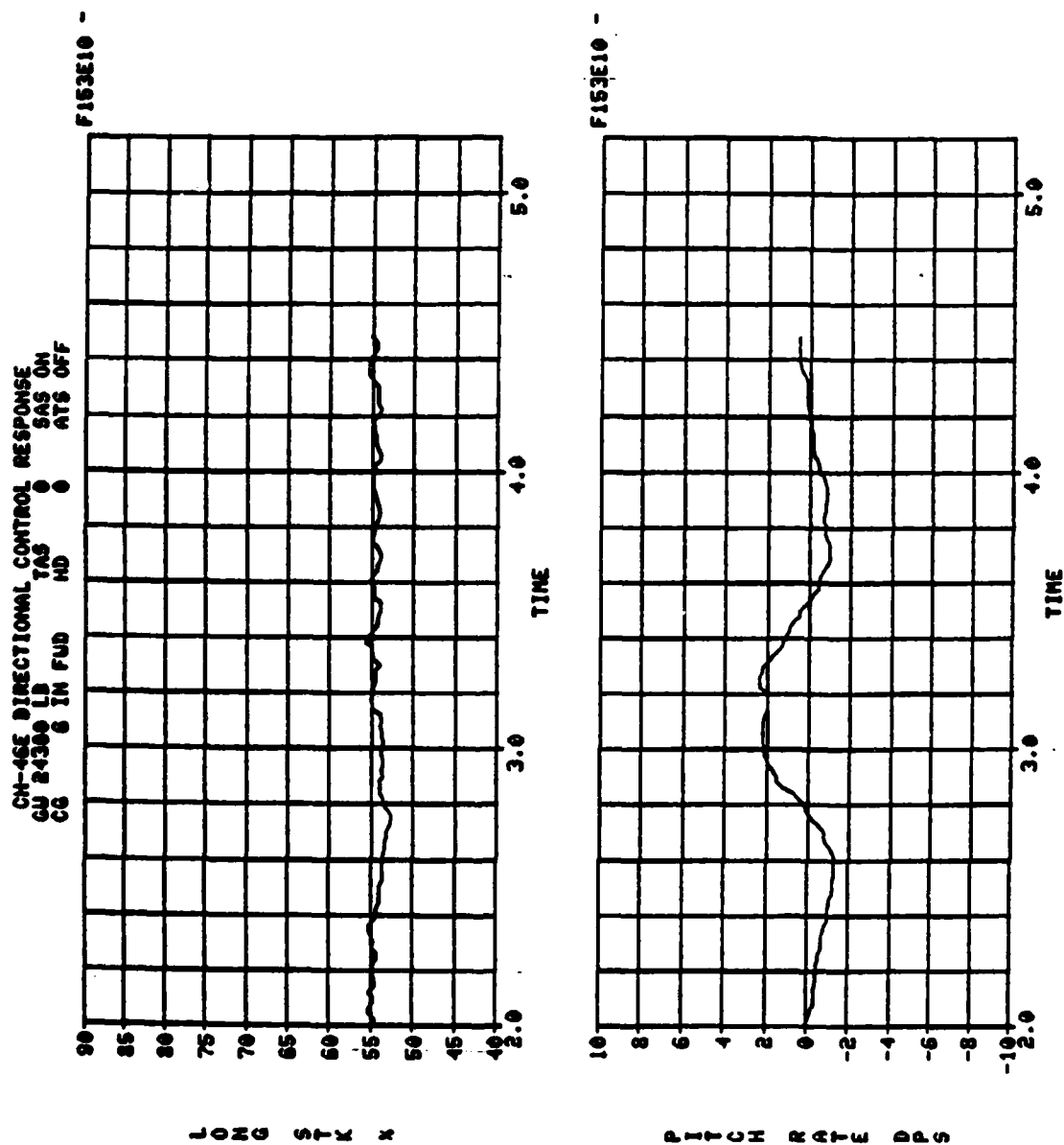


FIGURE 13F

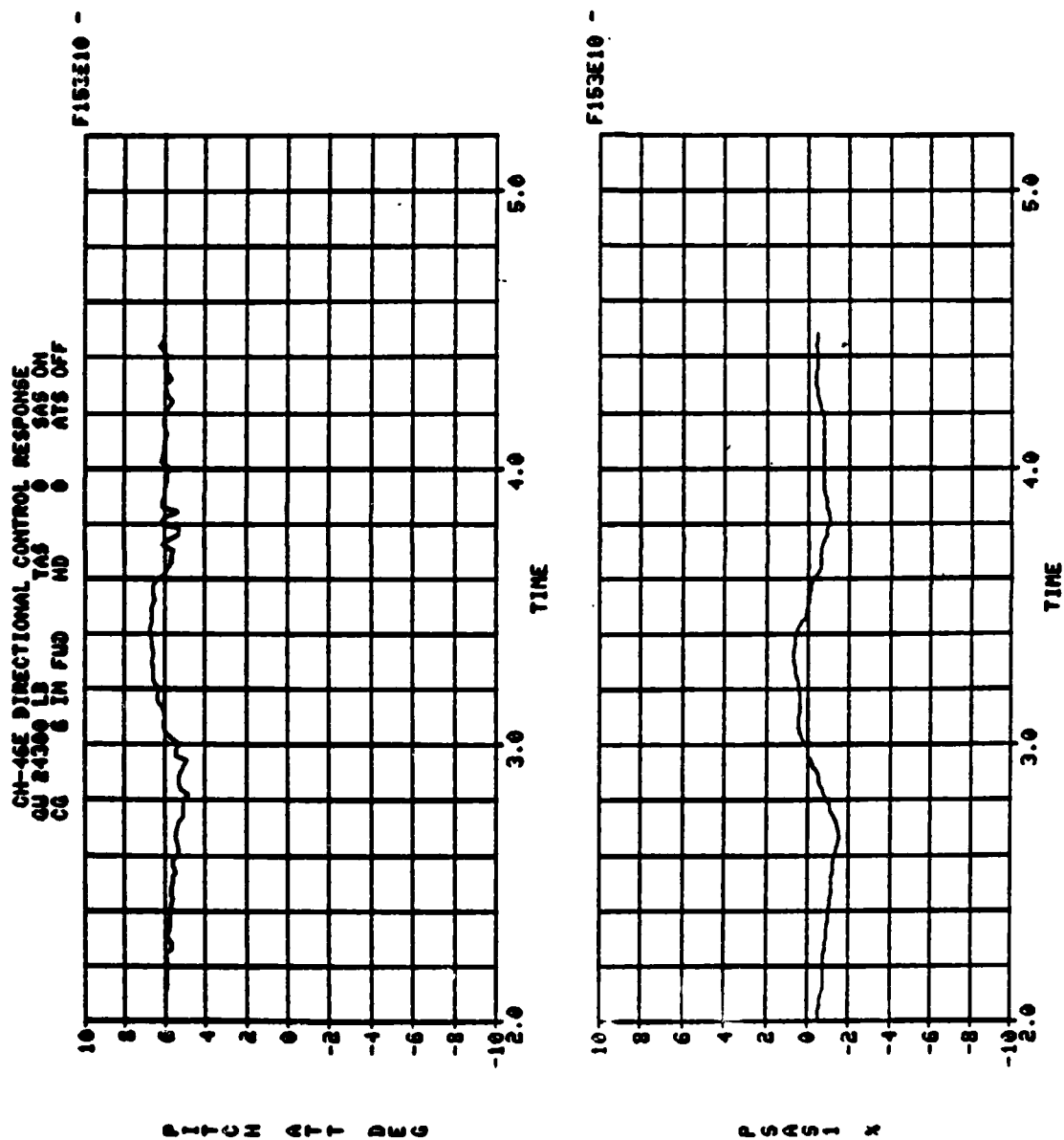


FIGURE 13G

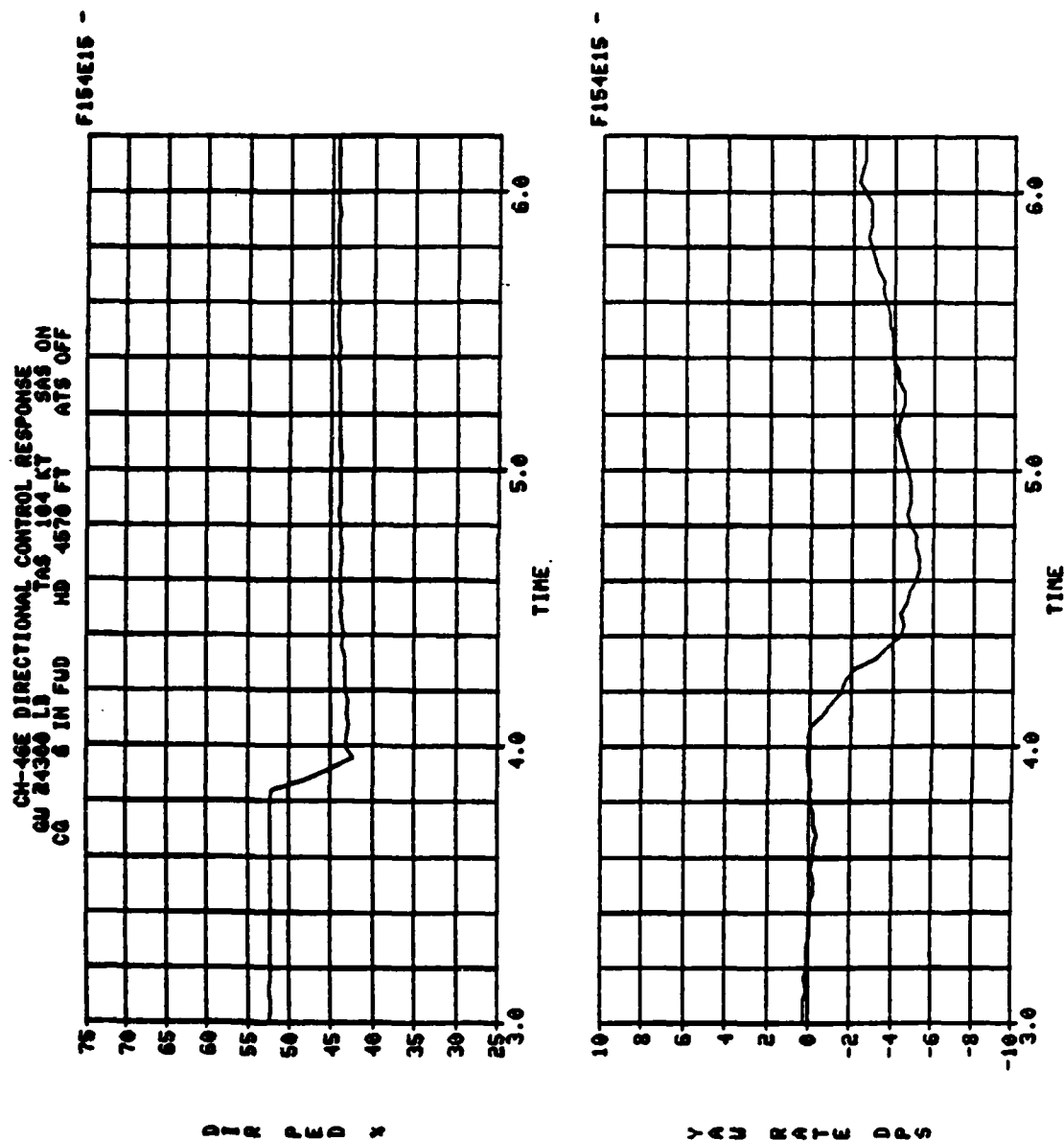


FIGURE 14A

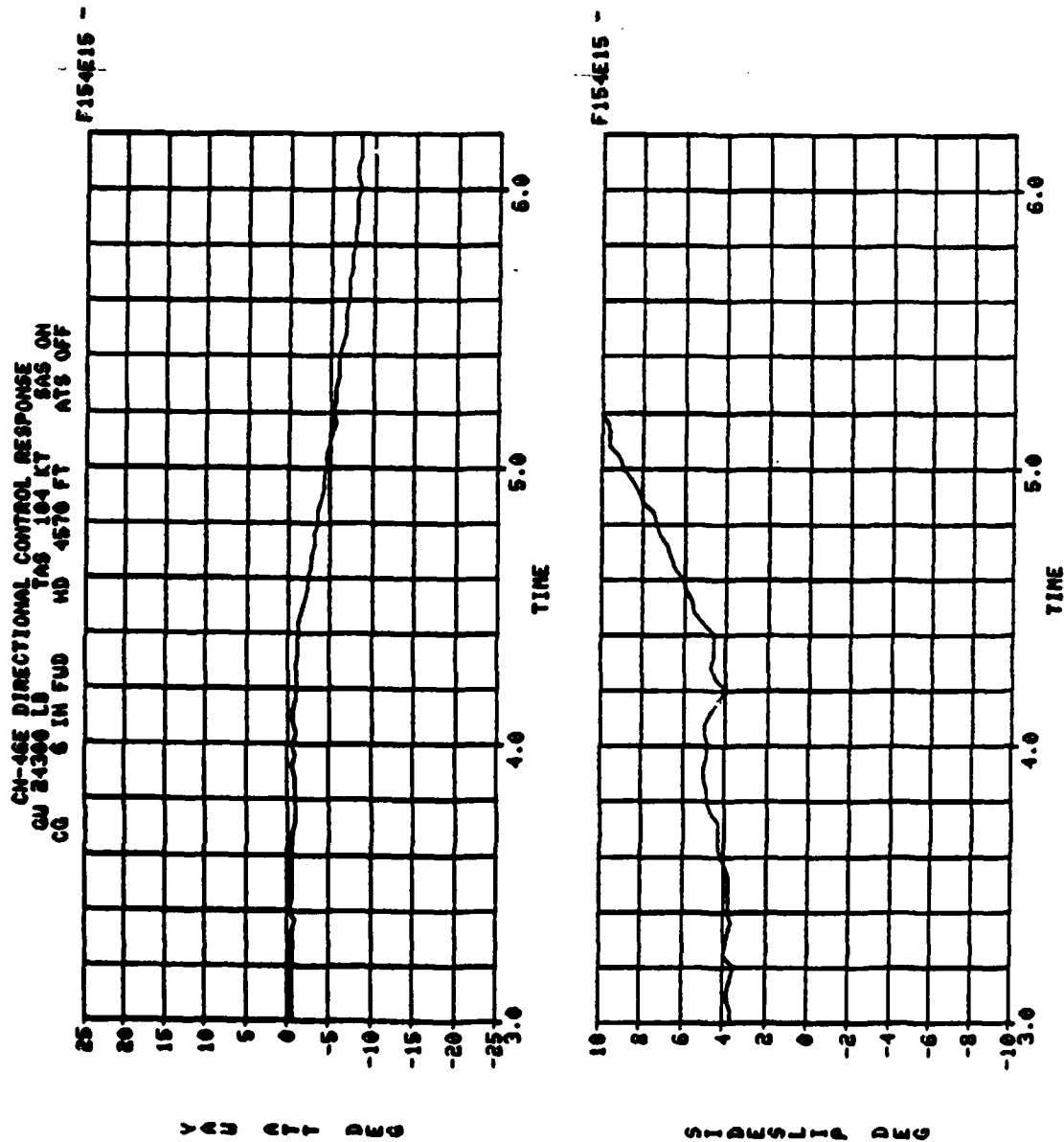


FIGURE 14B

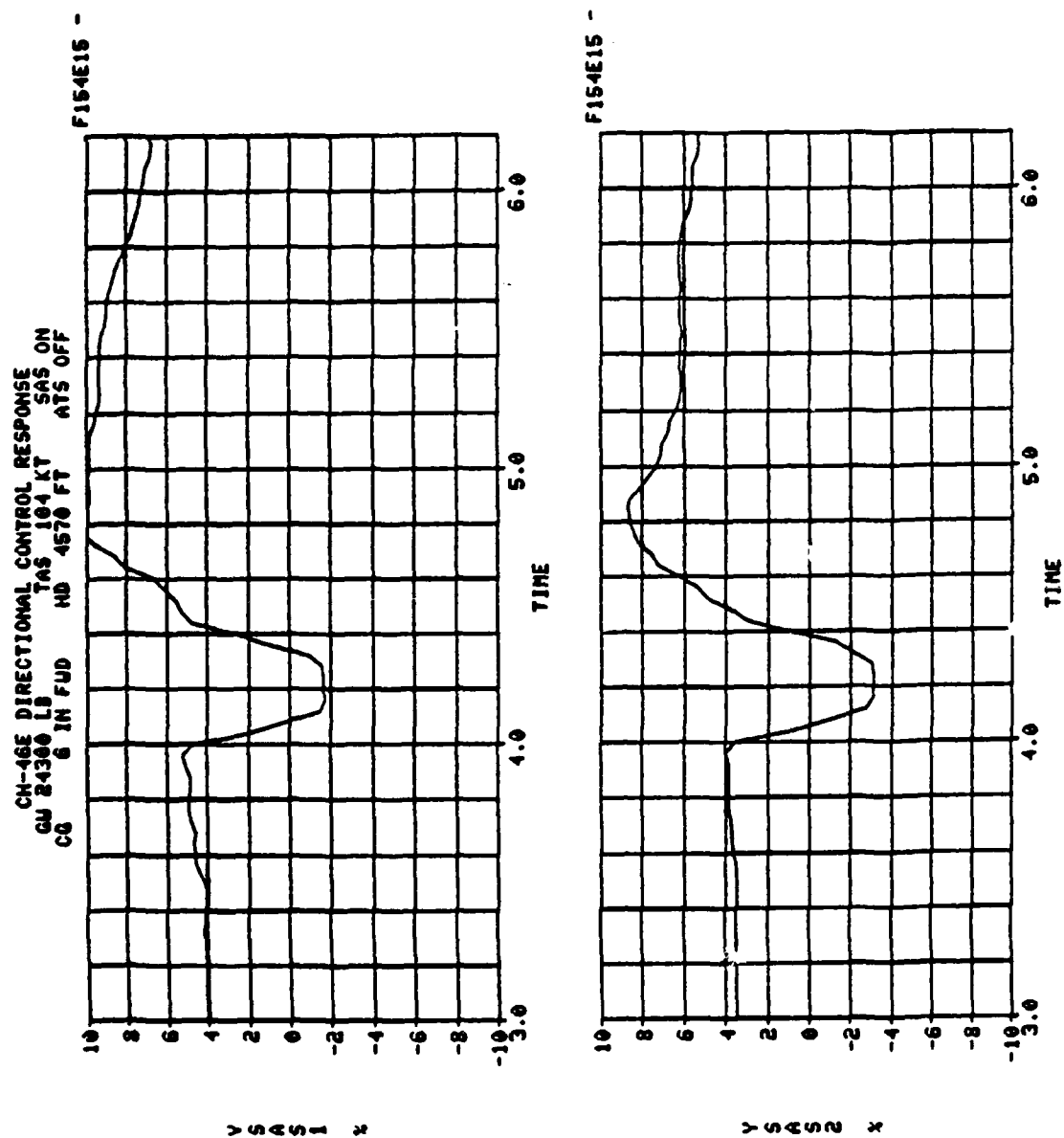


FIGURE 14C



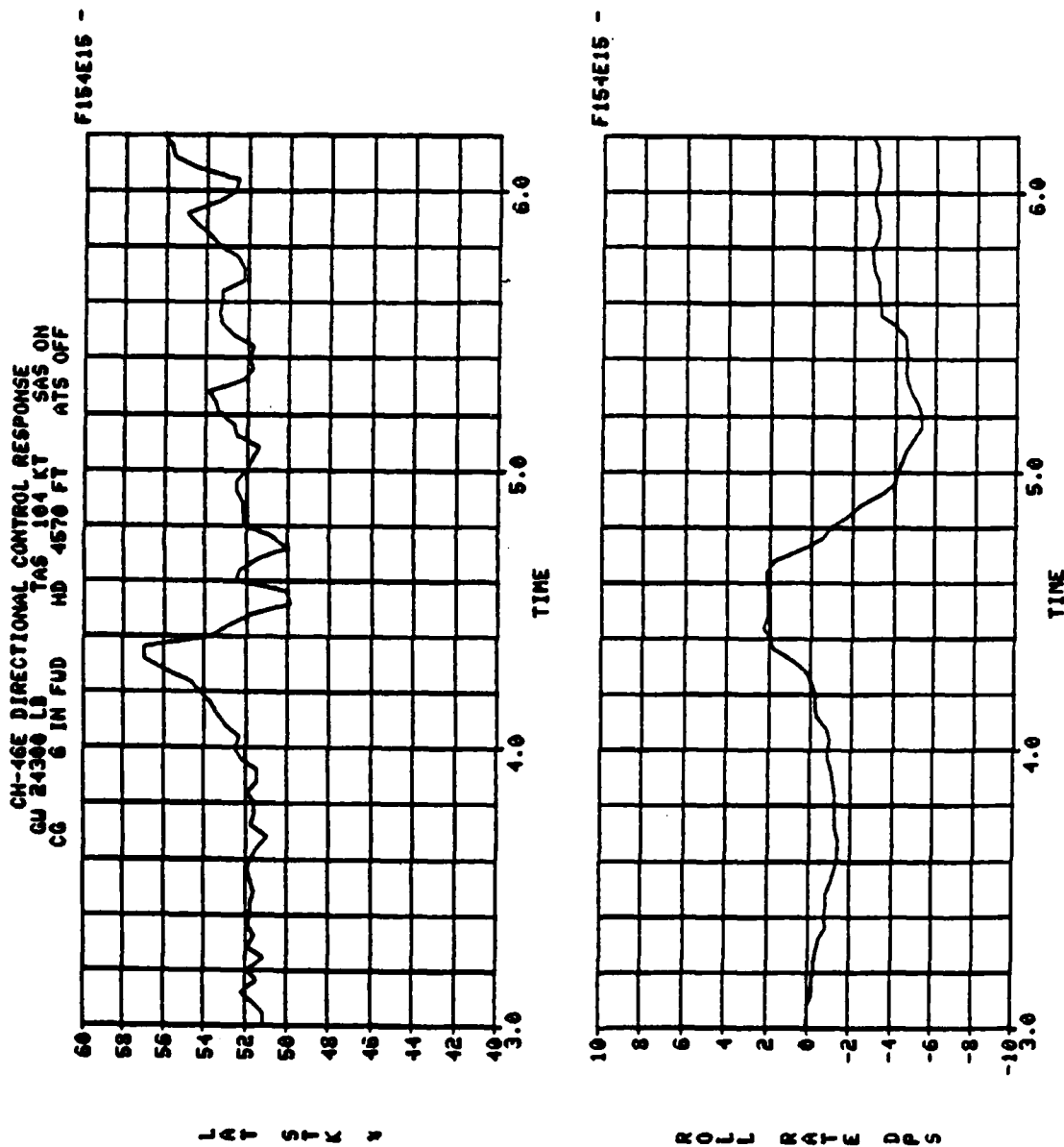


FIGURE 14D

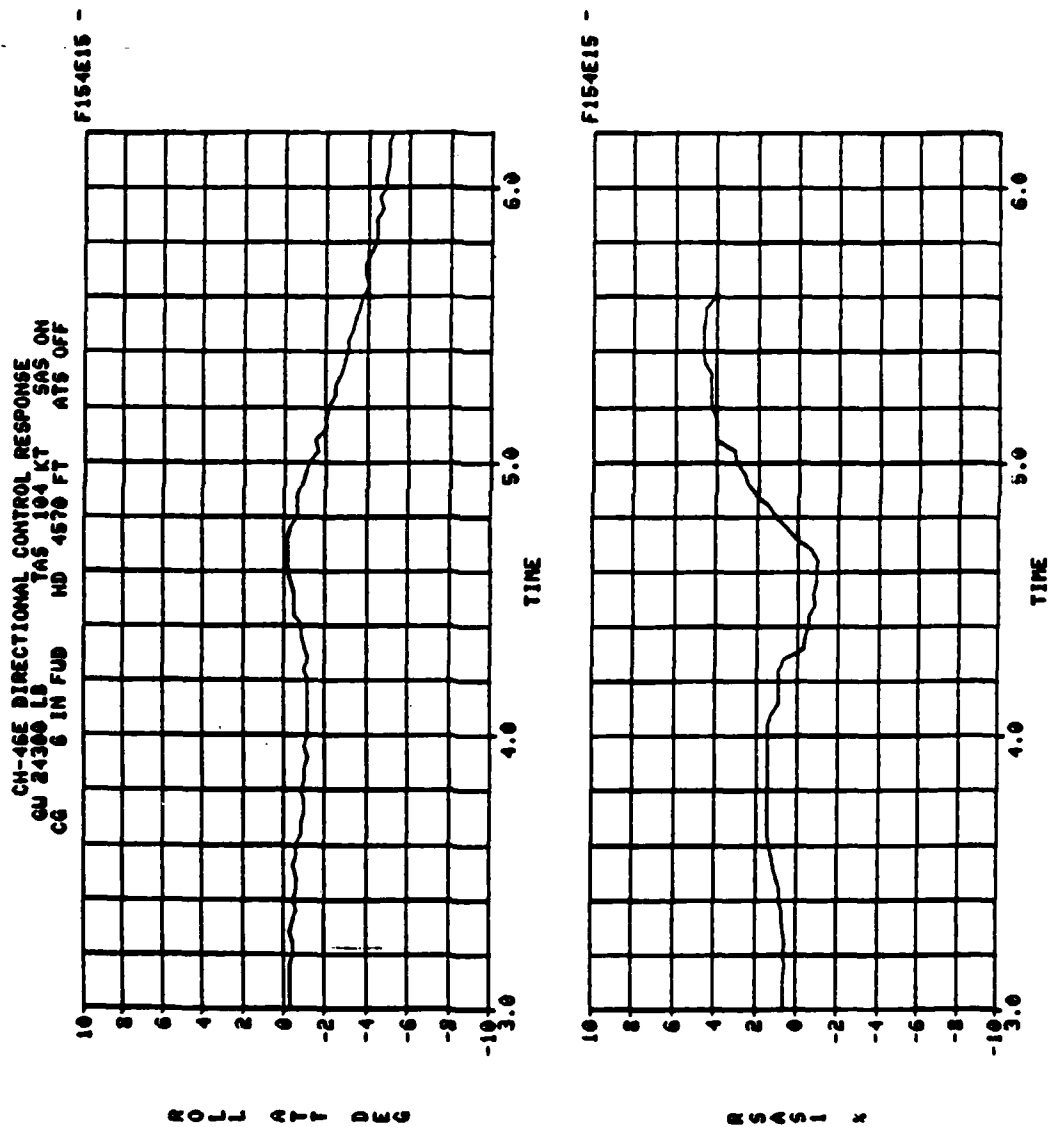


FIGURE 14E

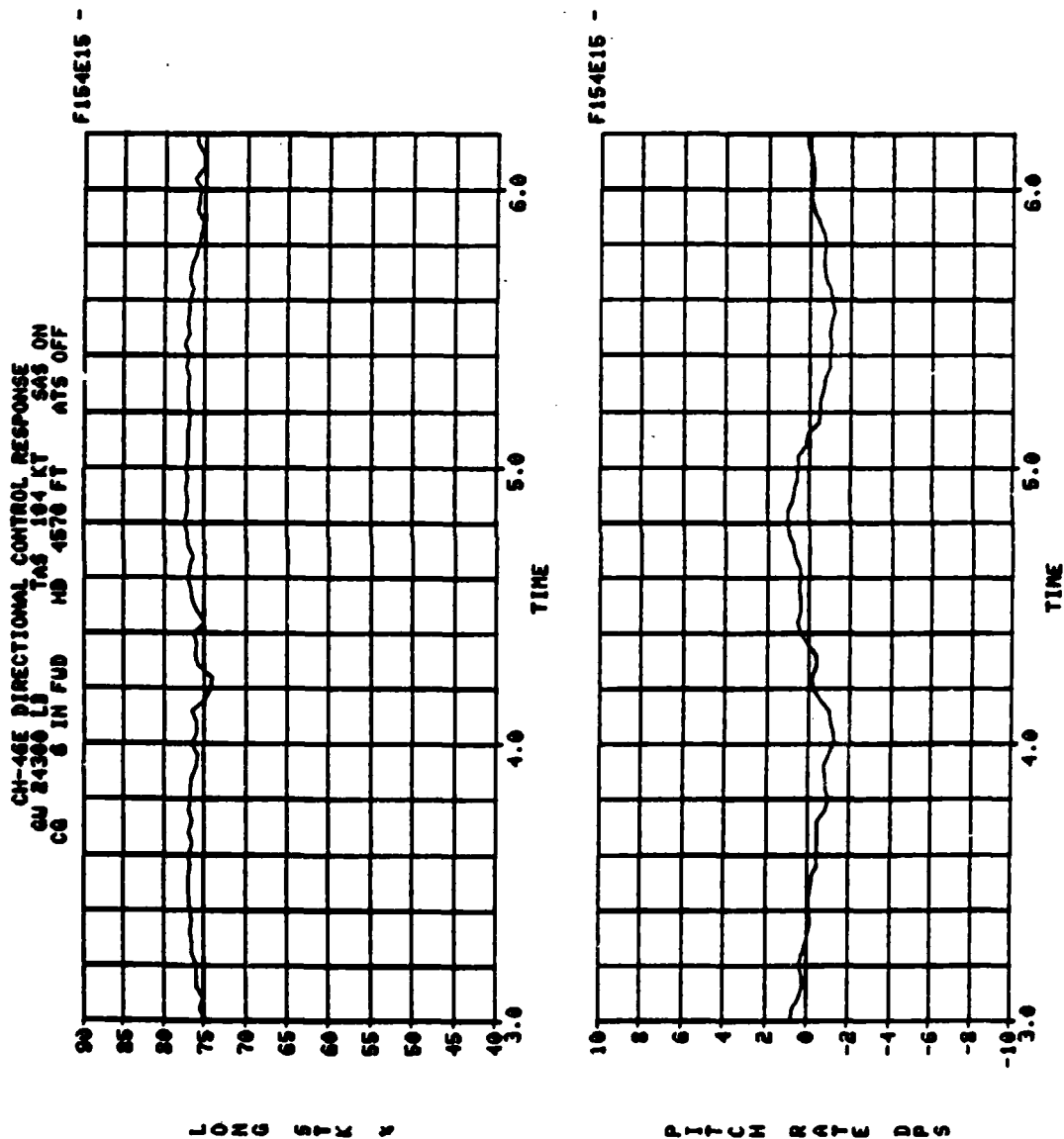


FIGURE 14F

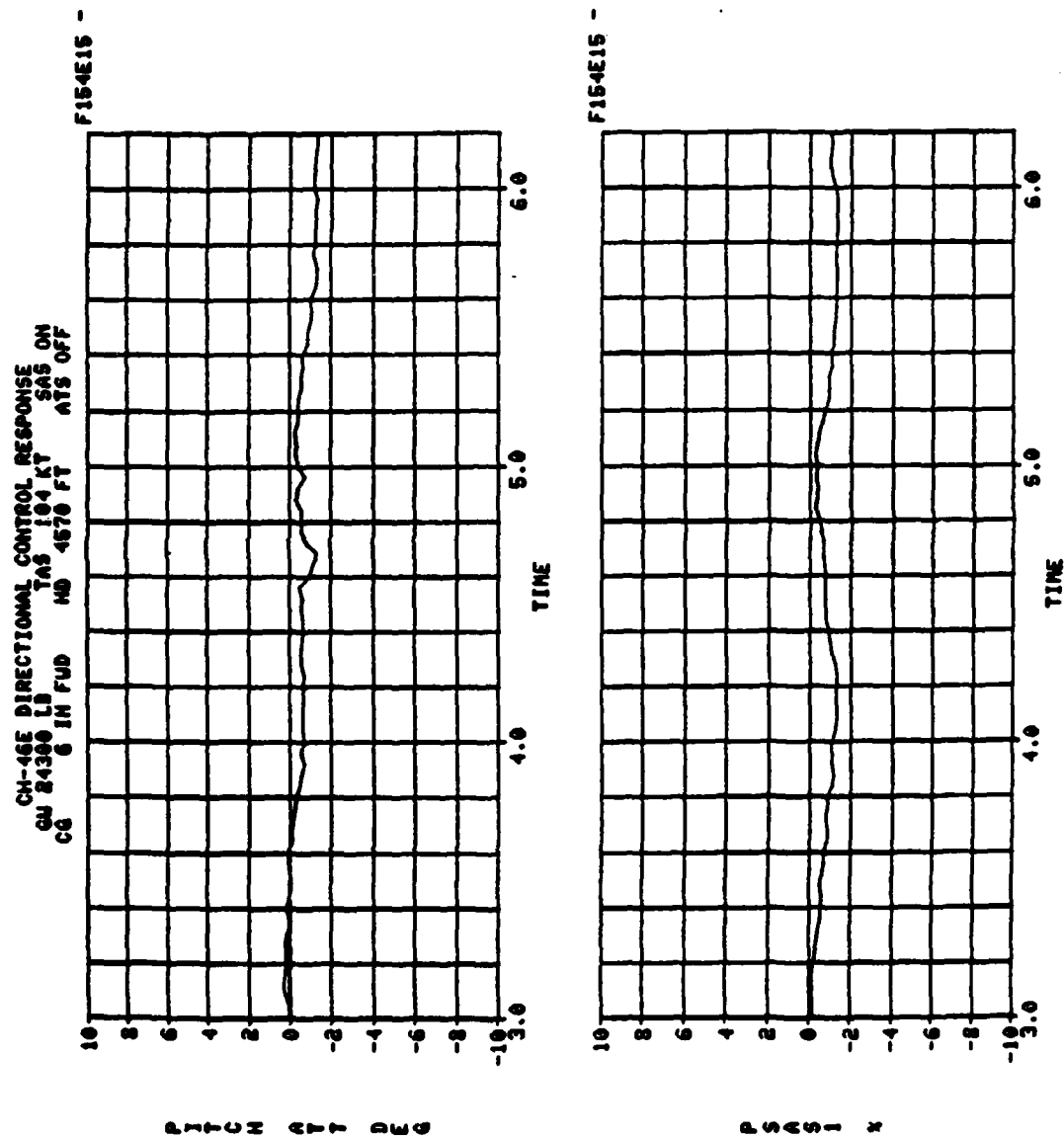


FIGURE 14G

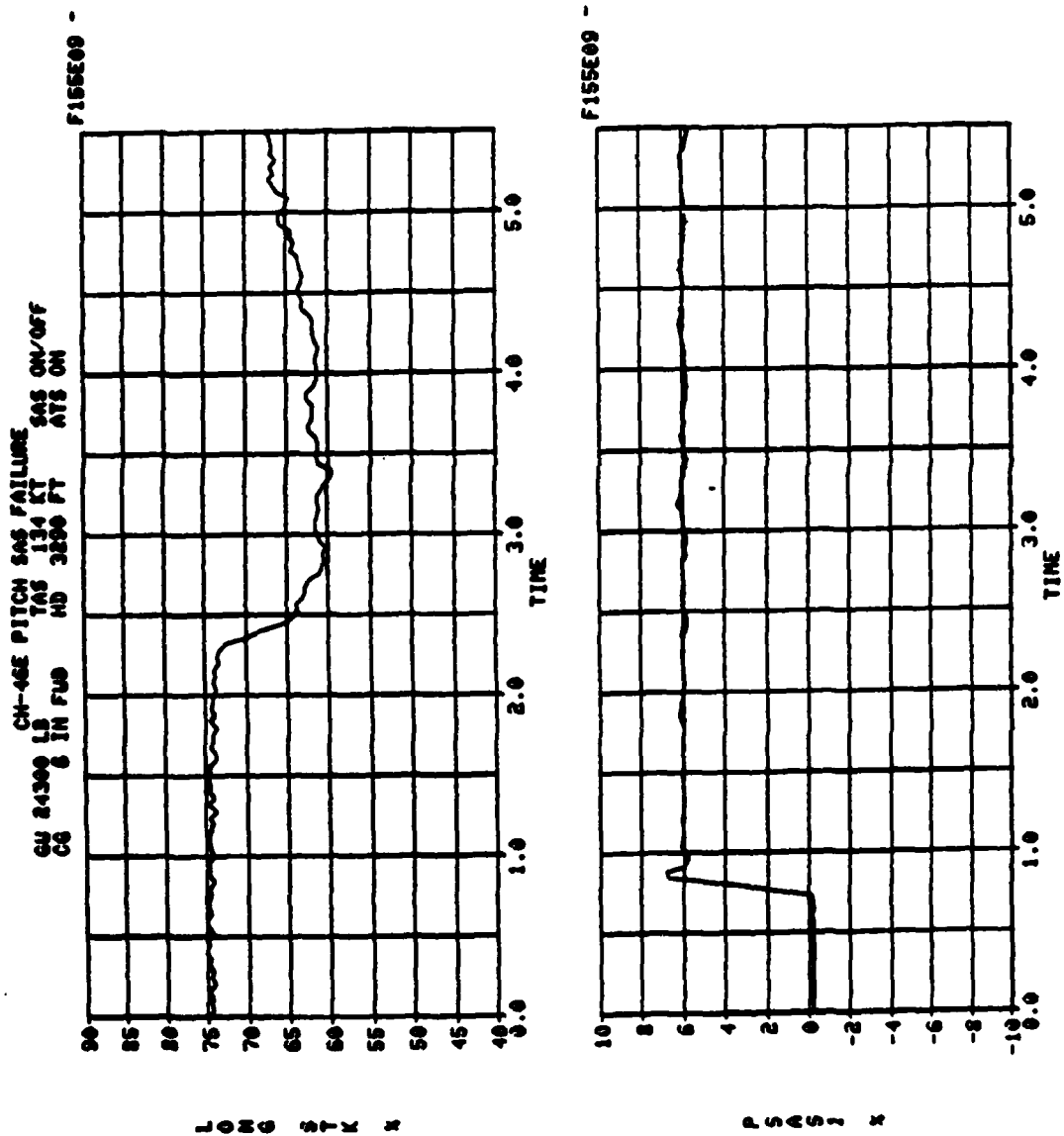


FIGURE 15A

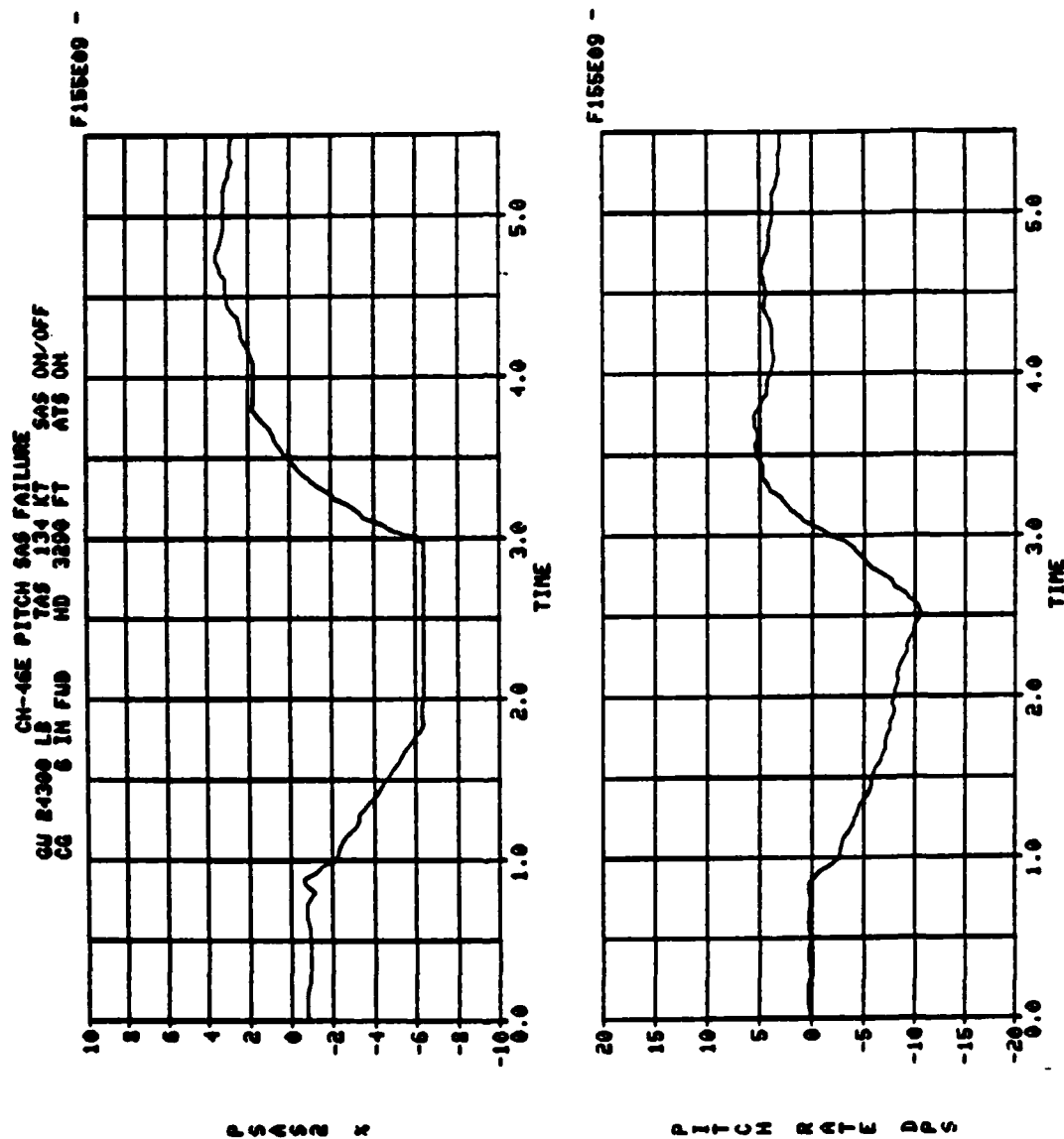


FIGURE 15B

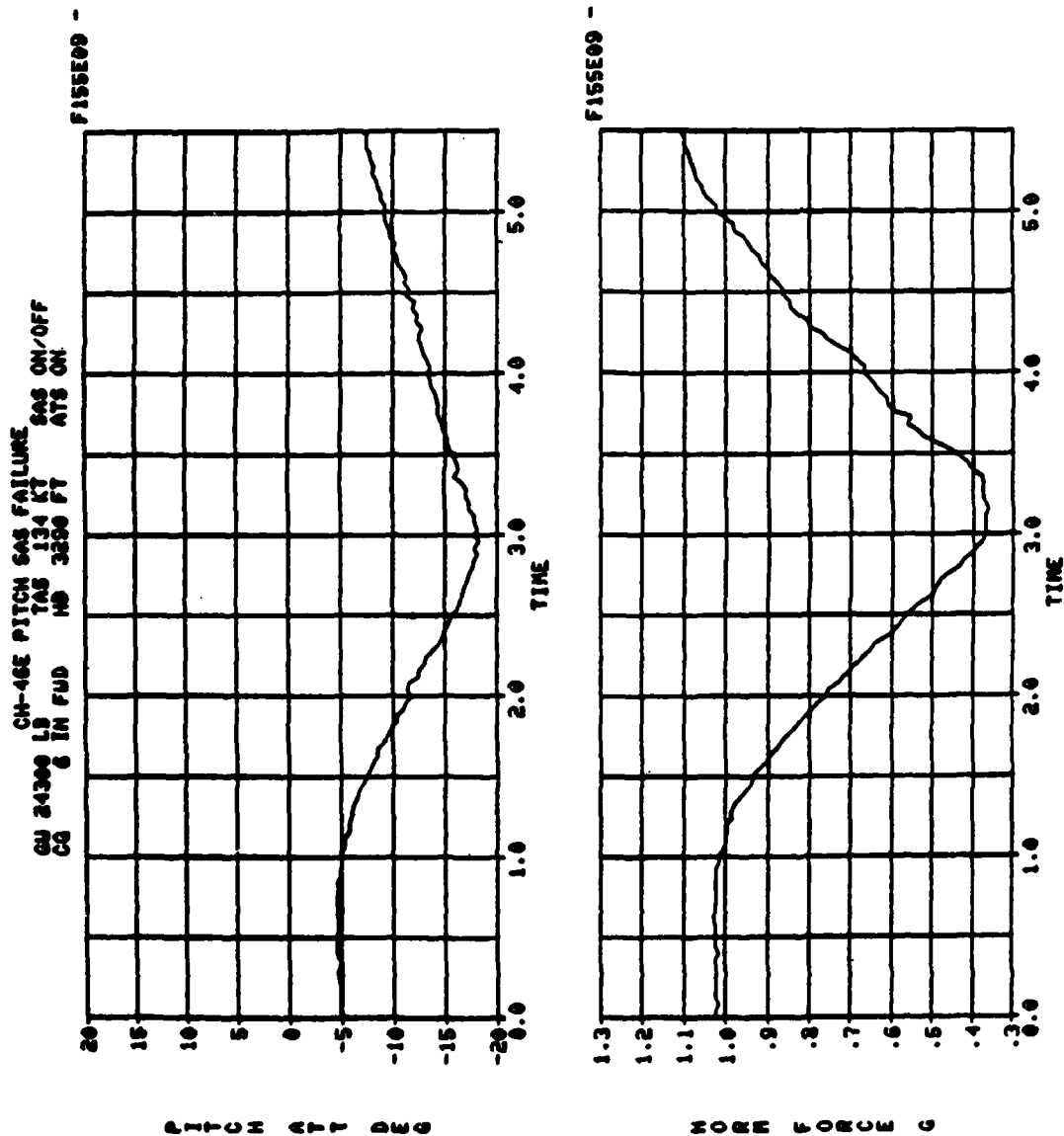


FIGURE 15C

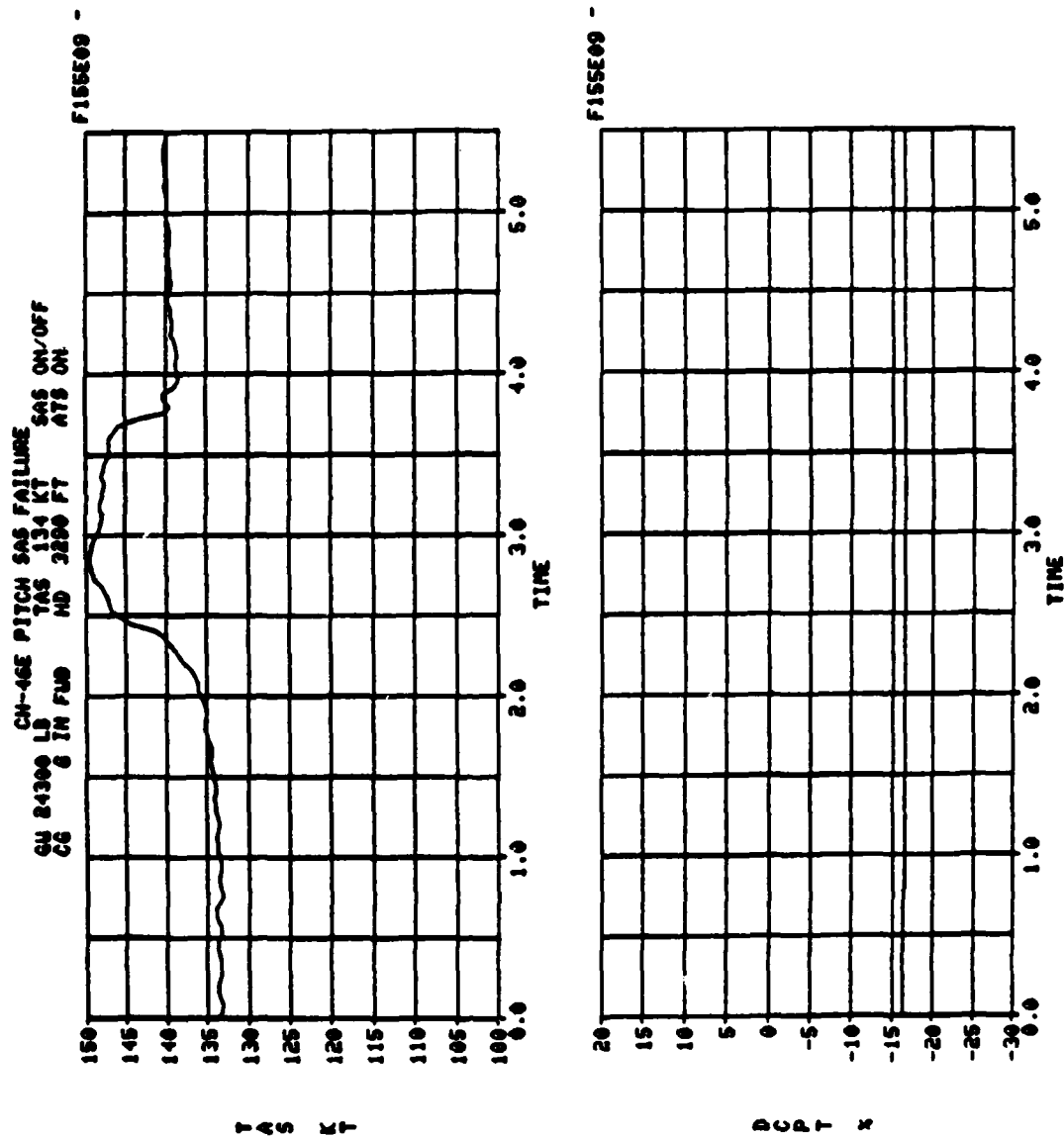


FIGURE 15D



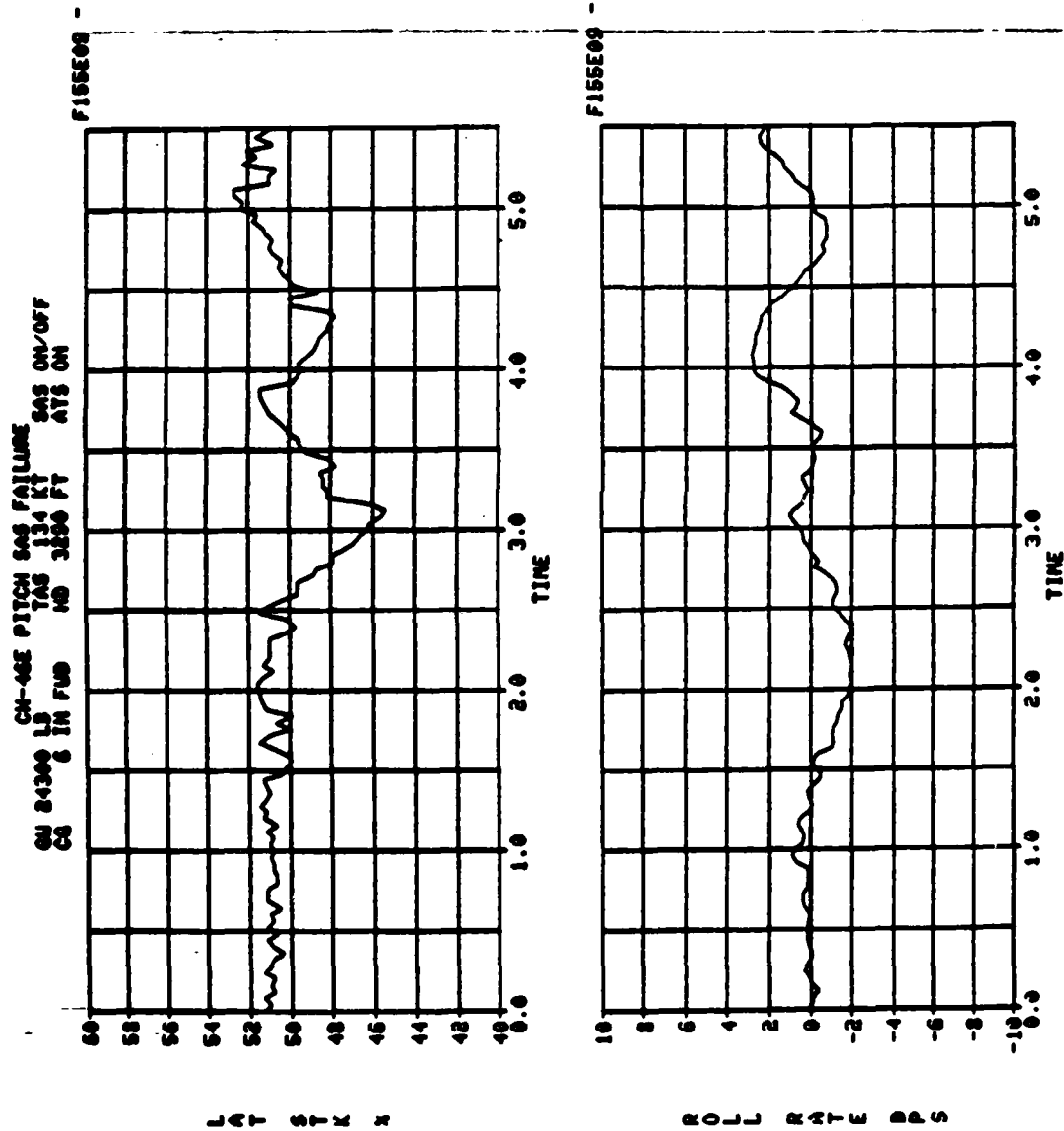


FIGURE 15E

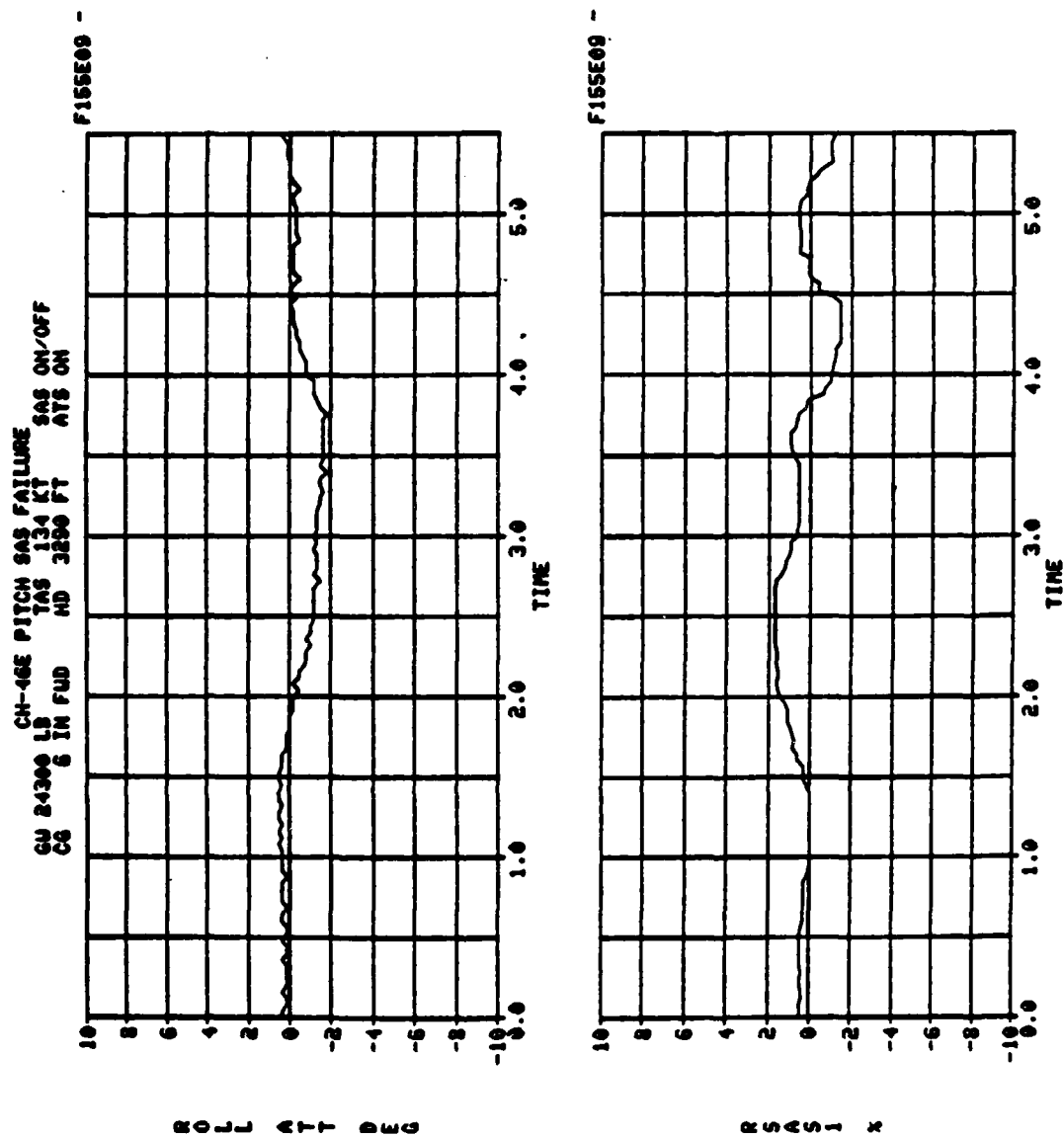


FIGURE 15F

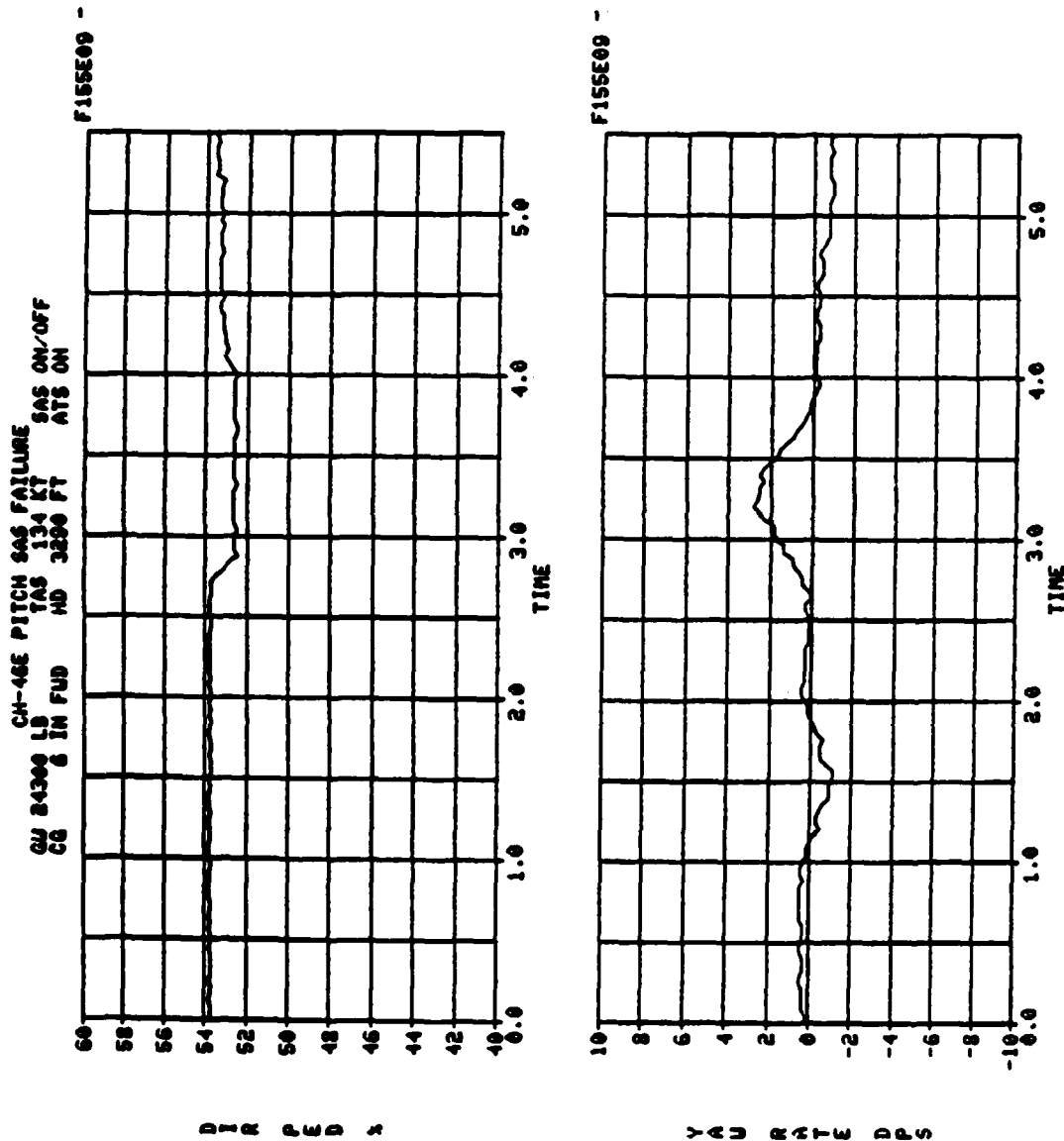


FIGURE 15G

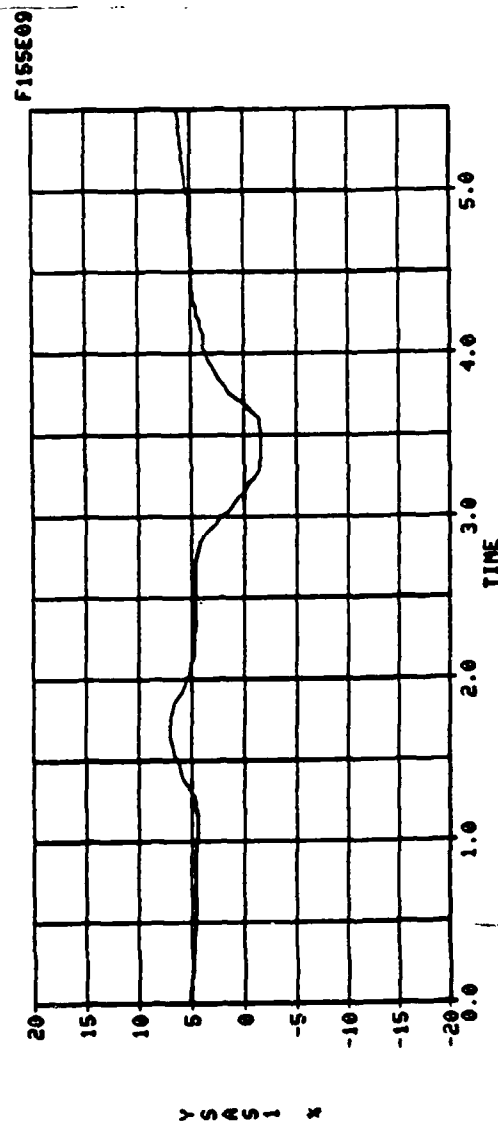
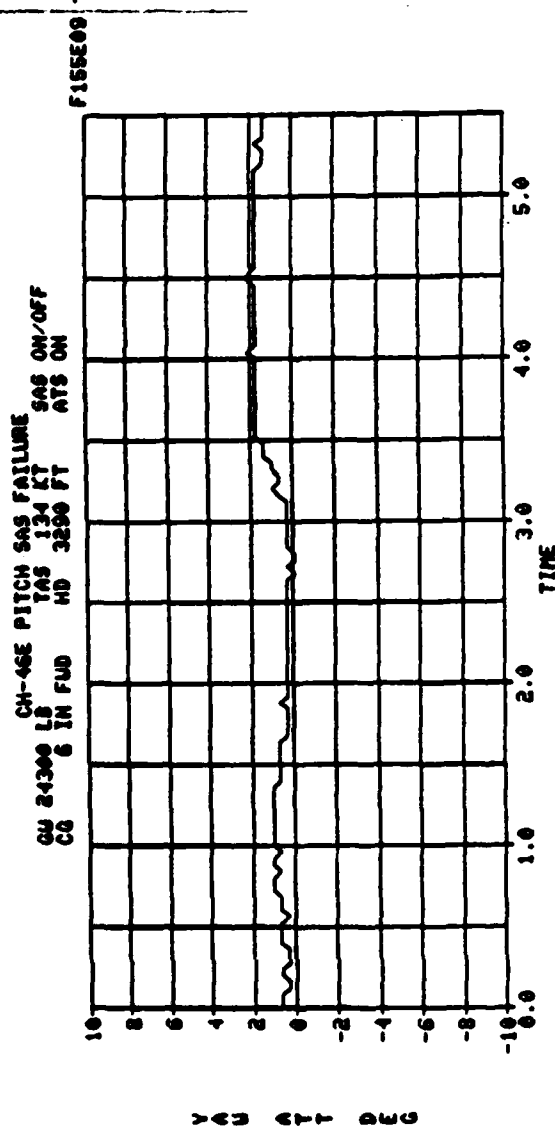


FIGURE 15H

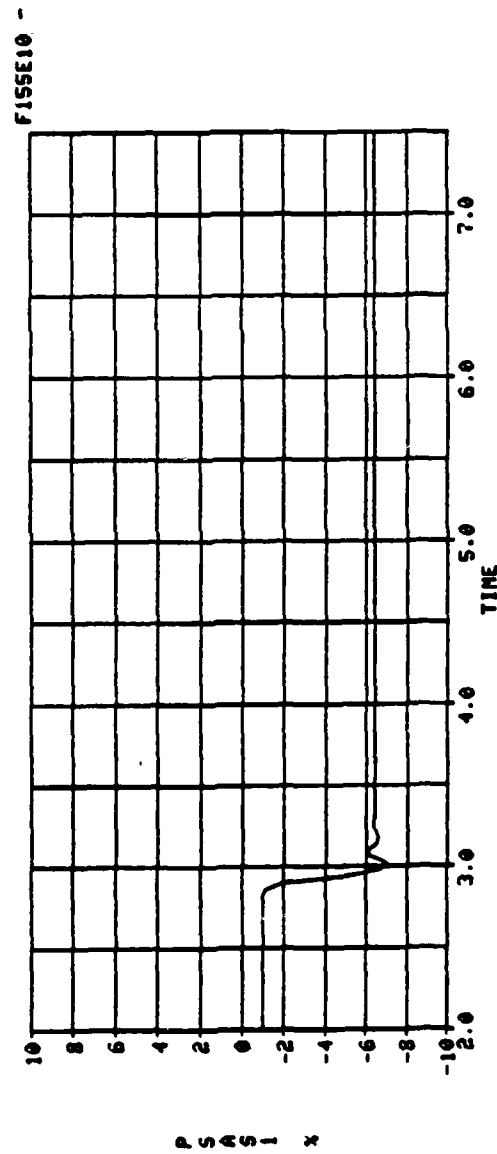
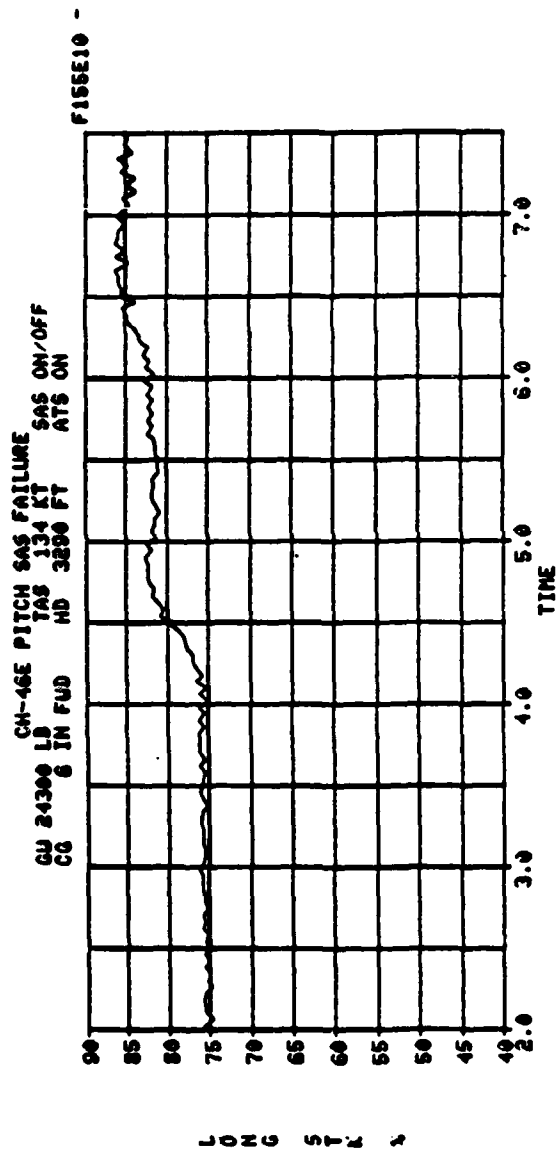


FIGURE 16A

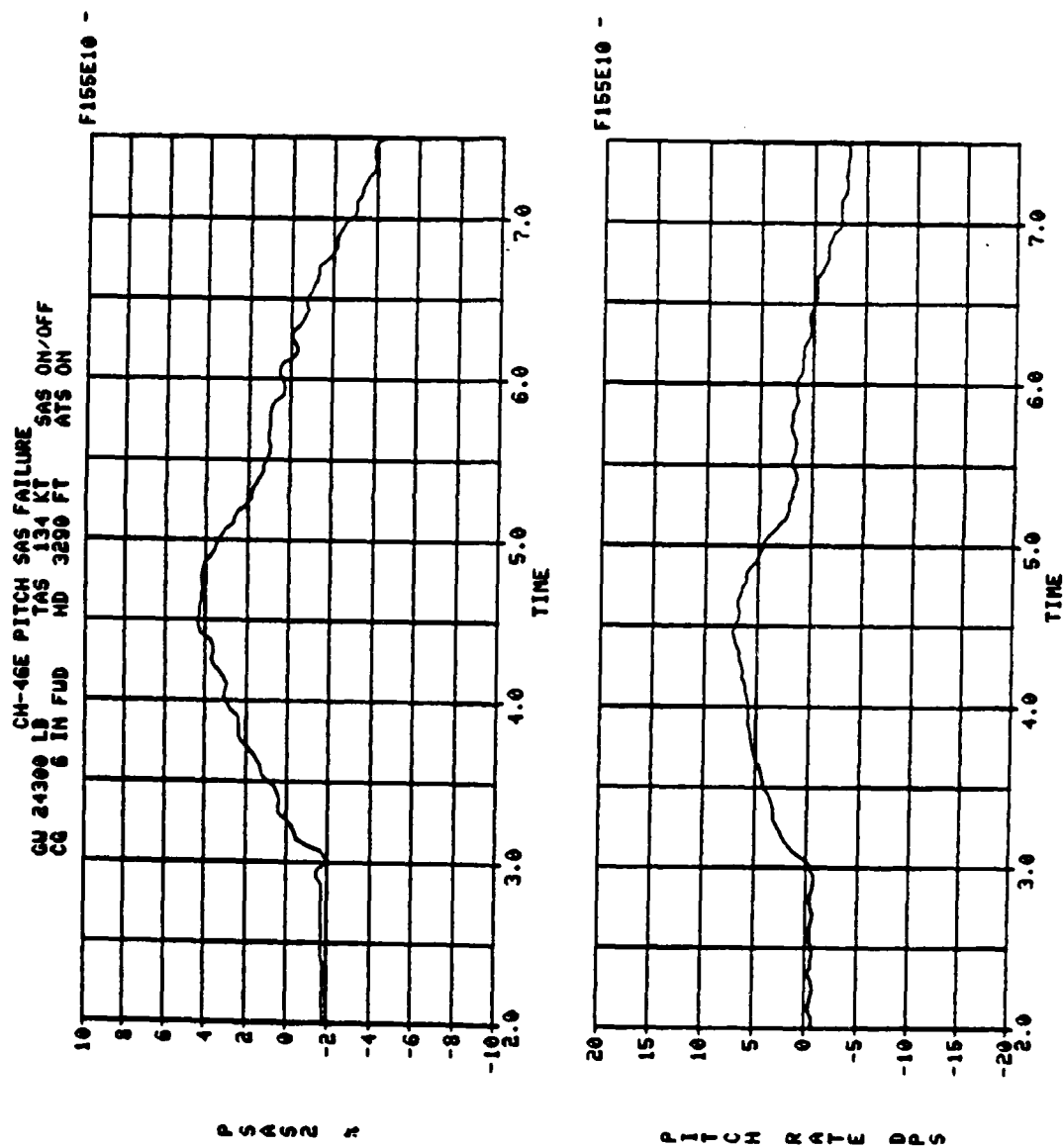


FIGURE 16B

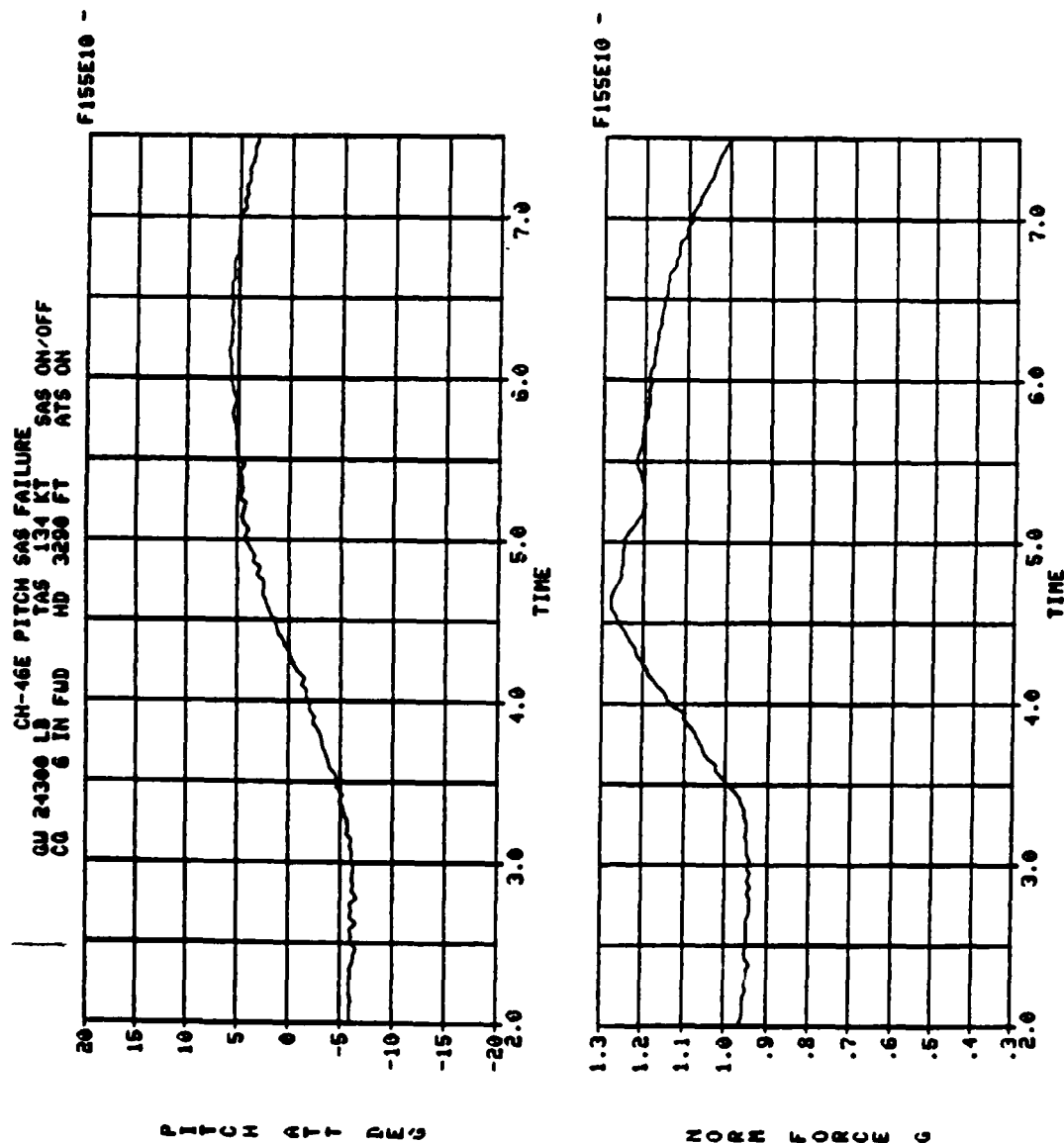


FIGURE 16C

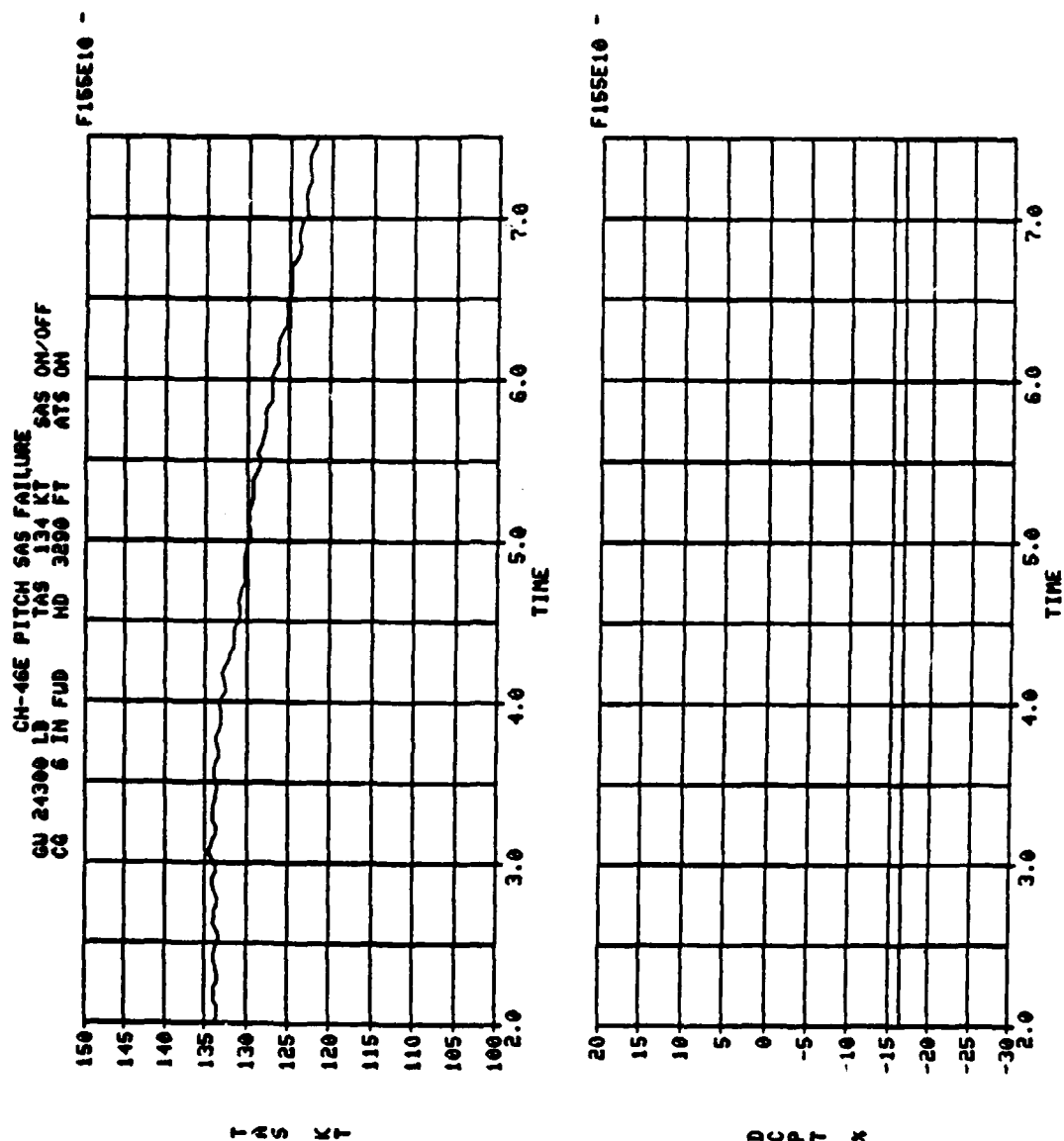


FIGURE 160



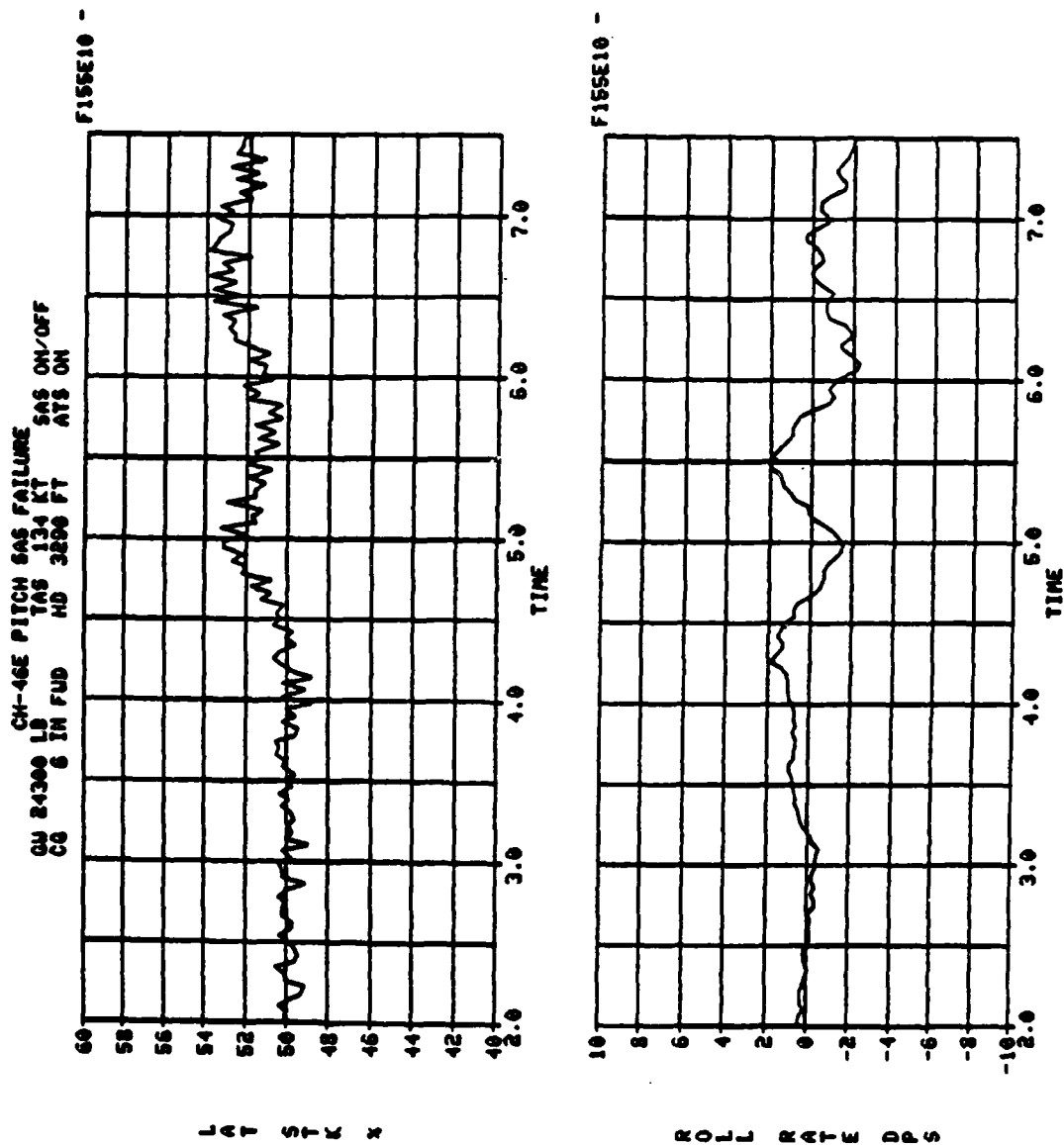


FIGURE 16E

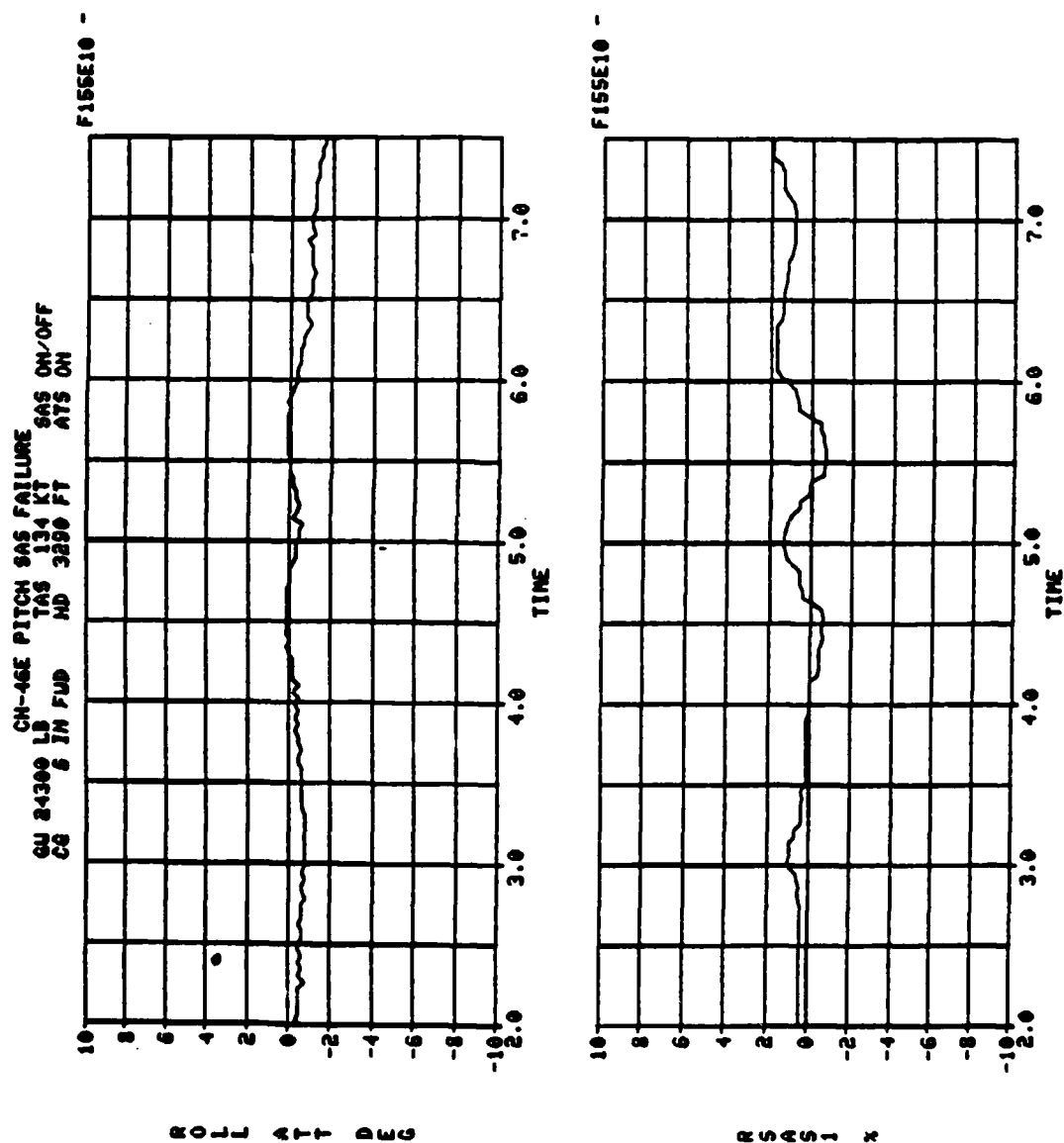


FIGURE 16F

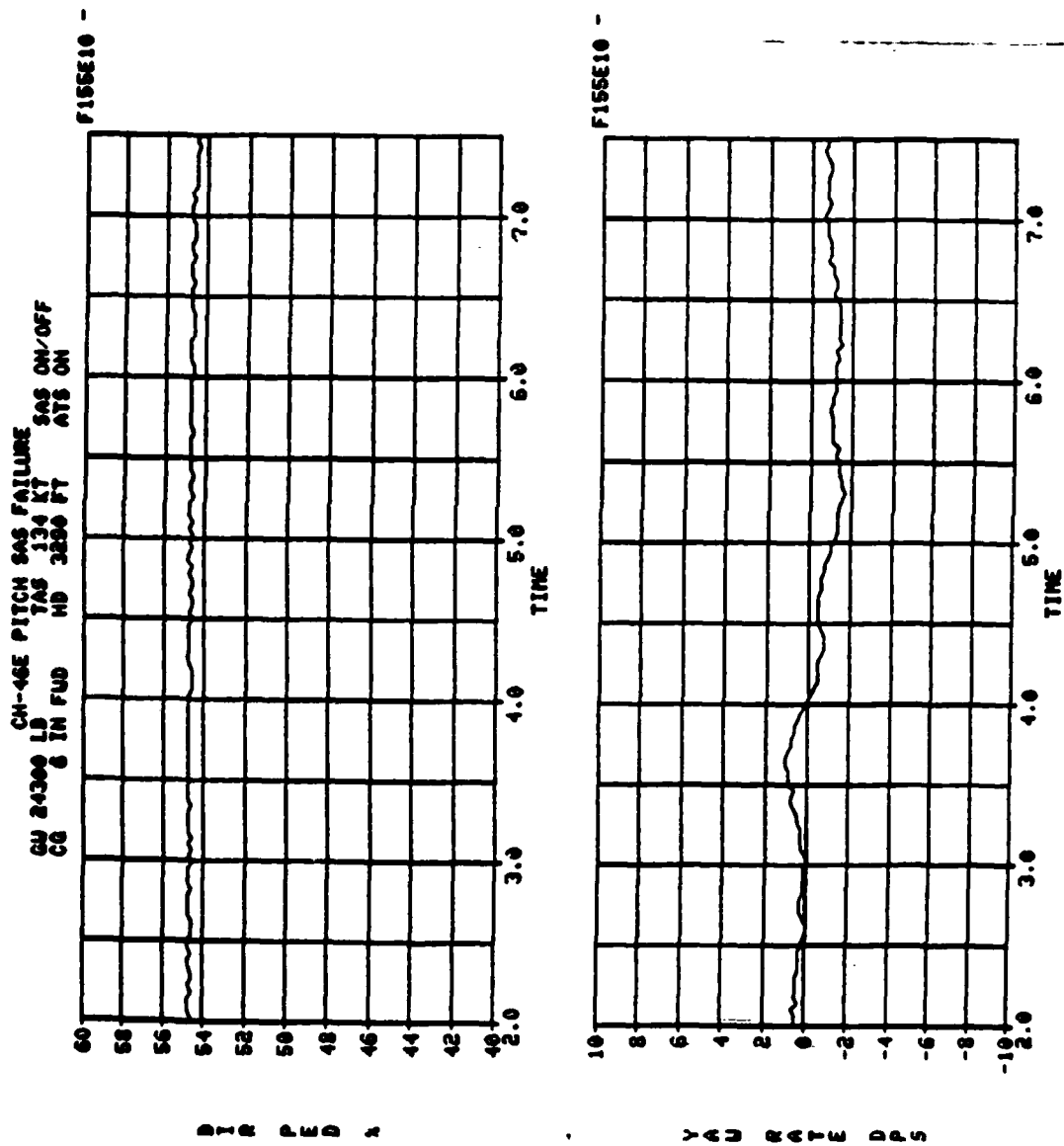


FIGURE 16G

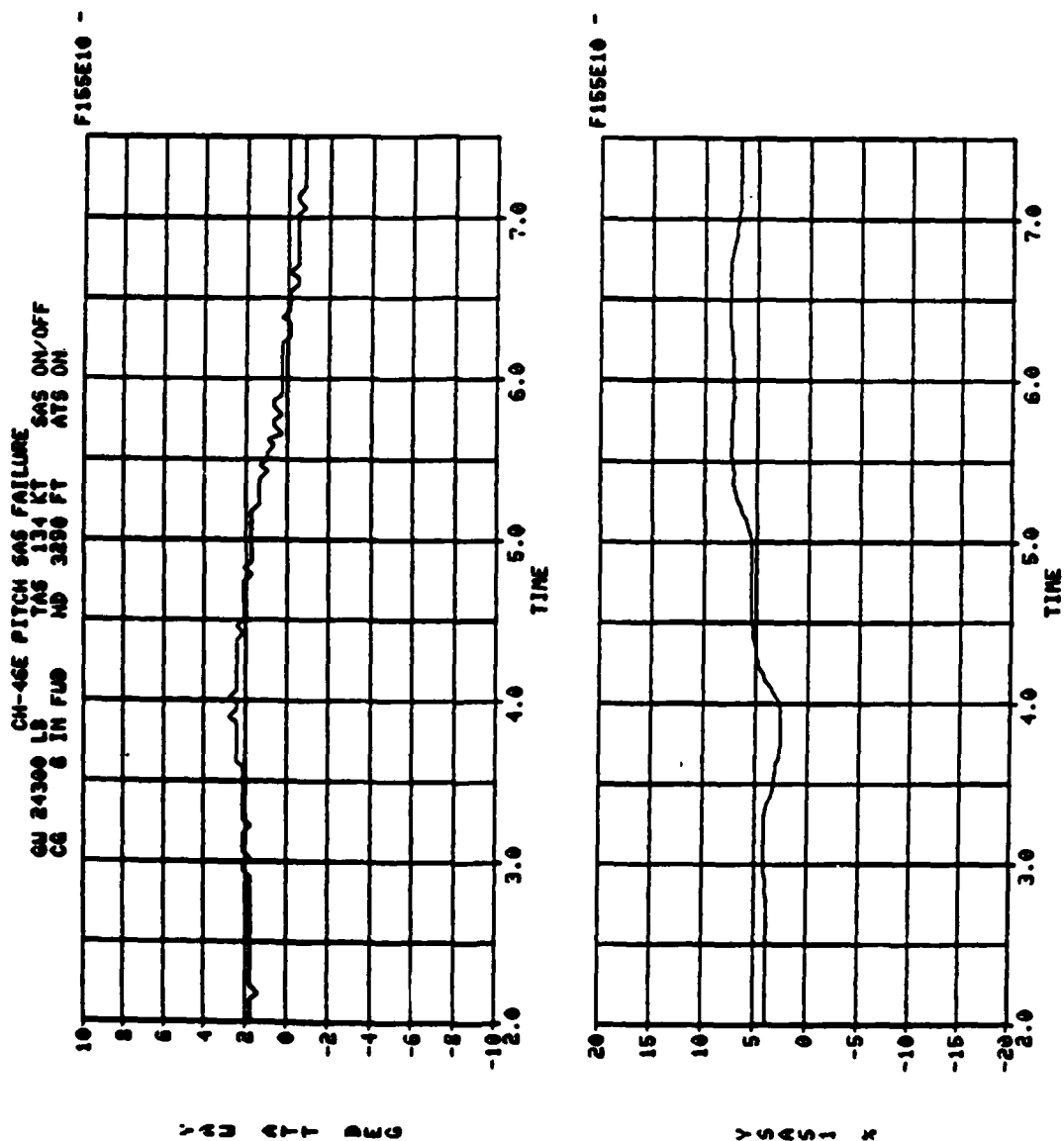


FIGURE 16H

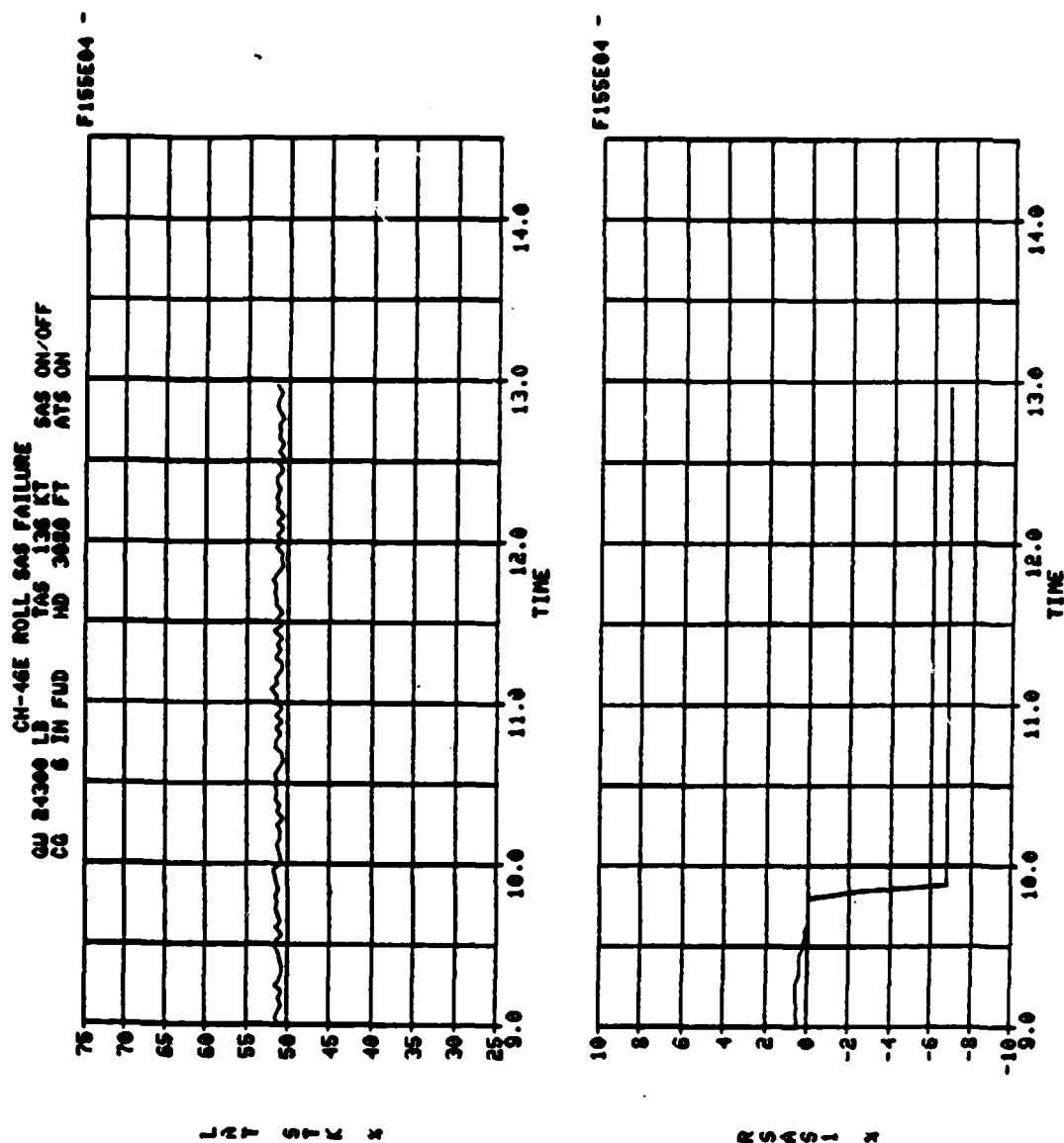


FIGURE 17A

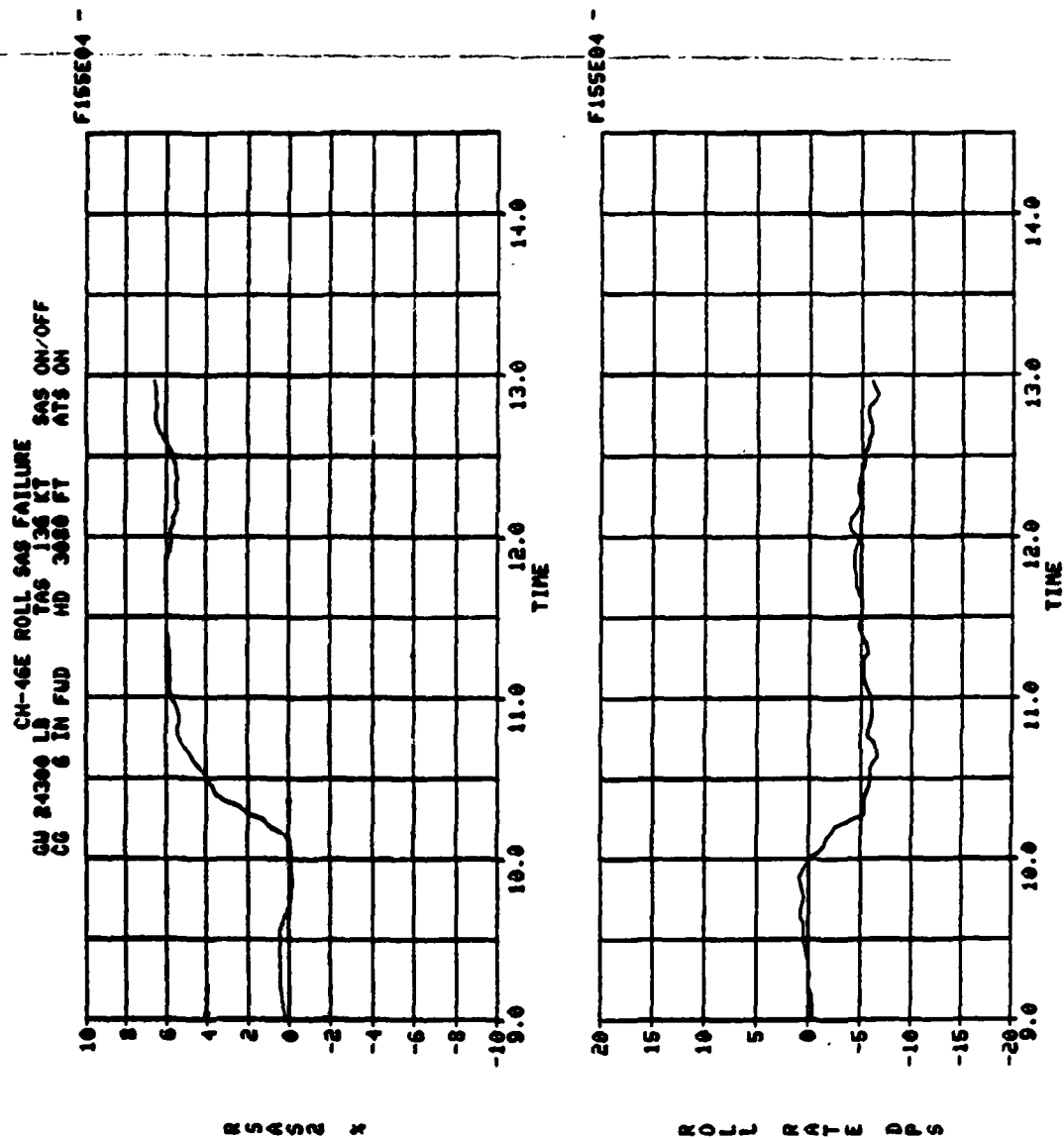


FIGURE 17B

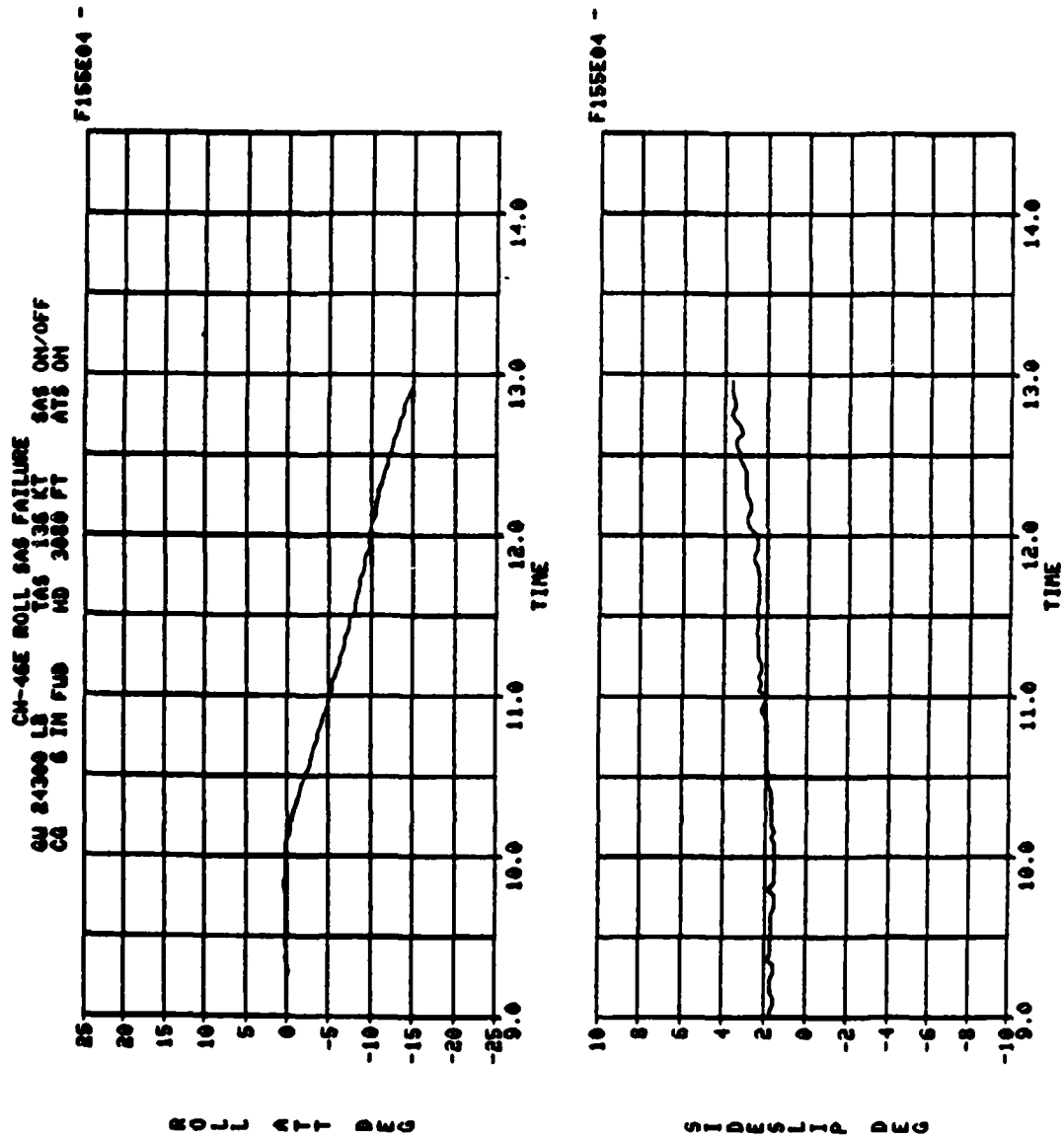


FIGURE 17C

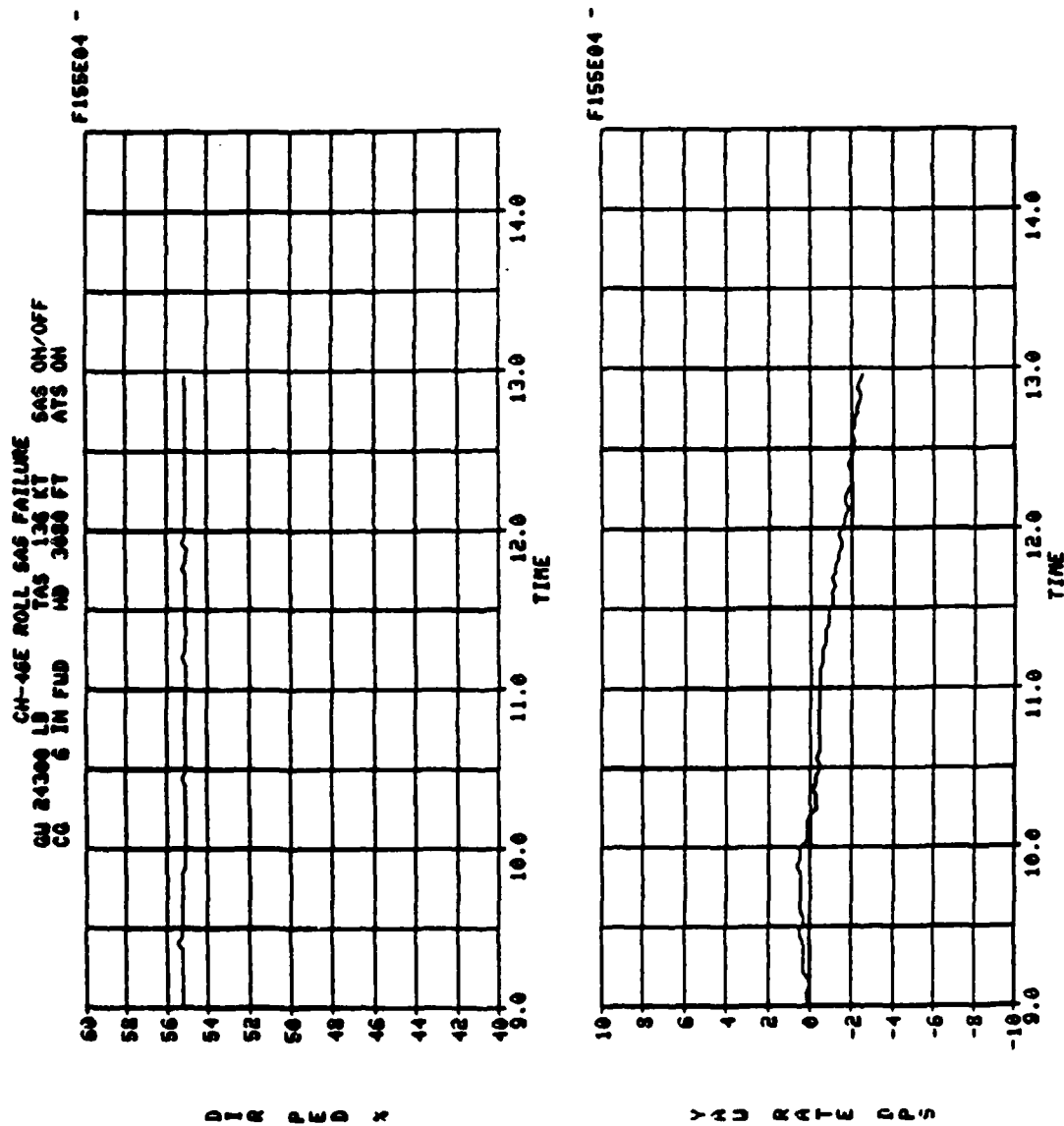


FIGURE 17D



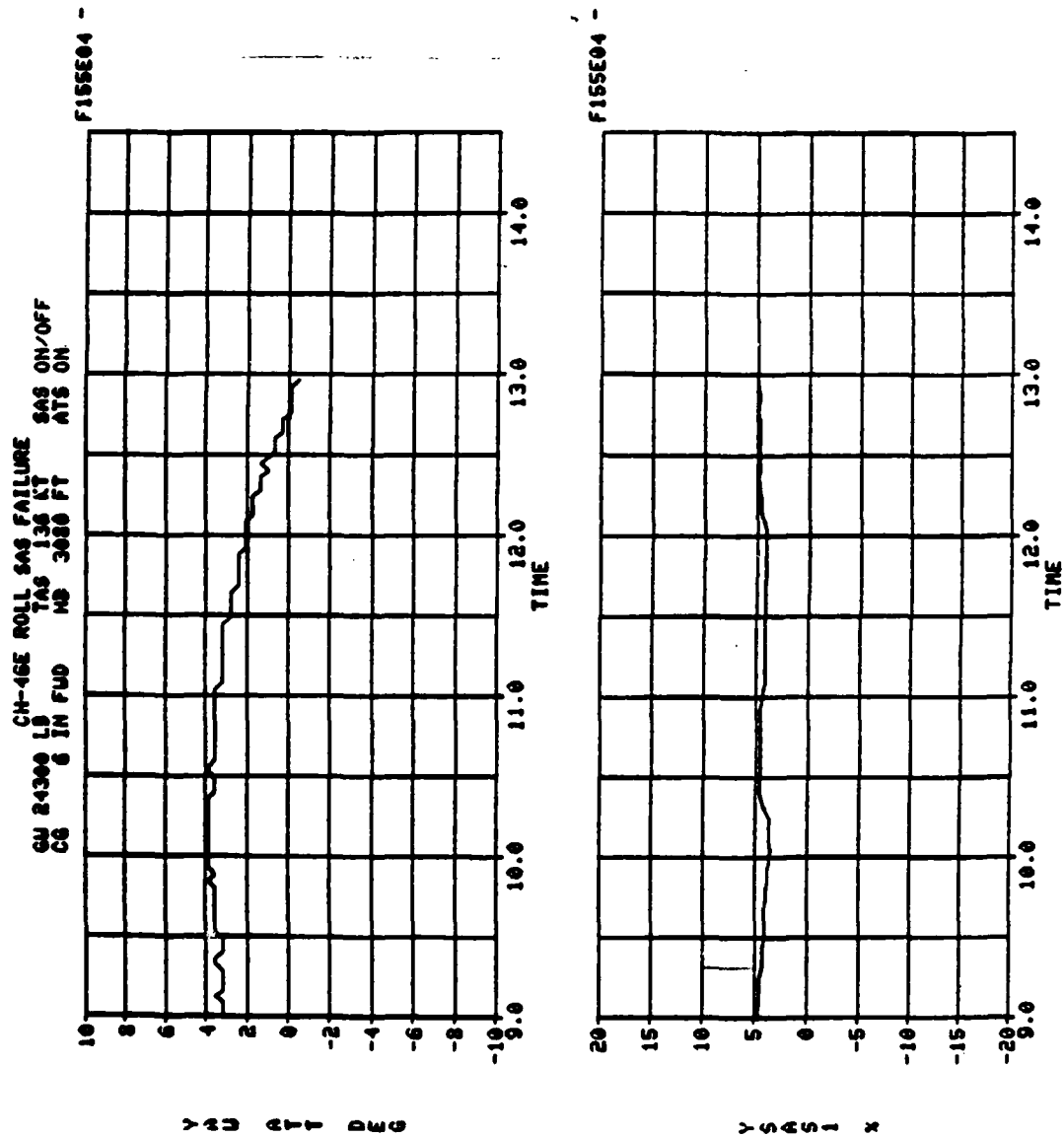


FIGURE 17E

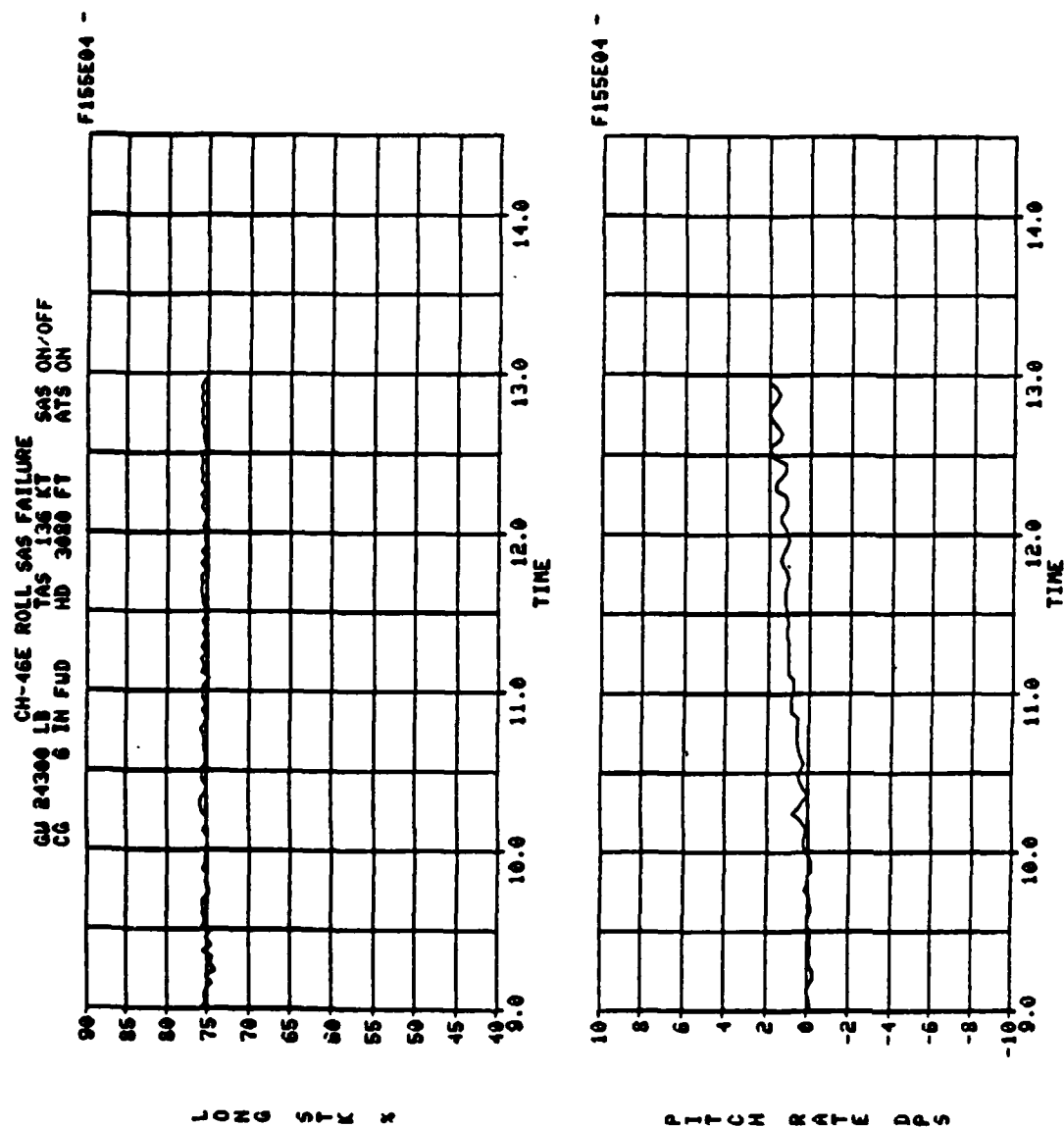


FIGURE 17F

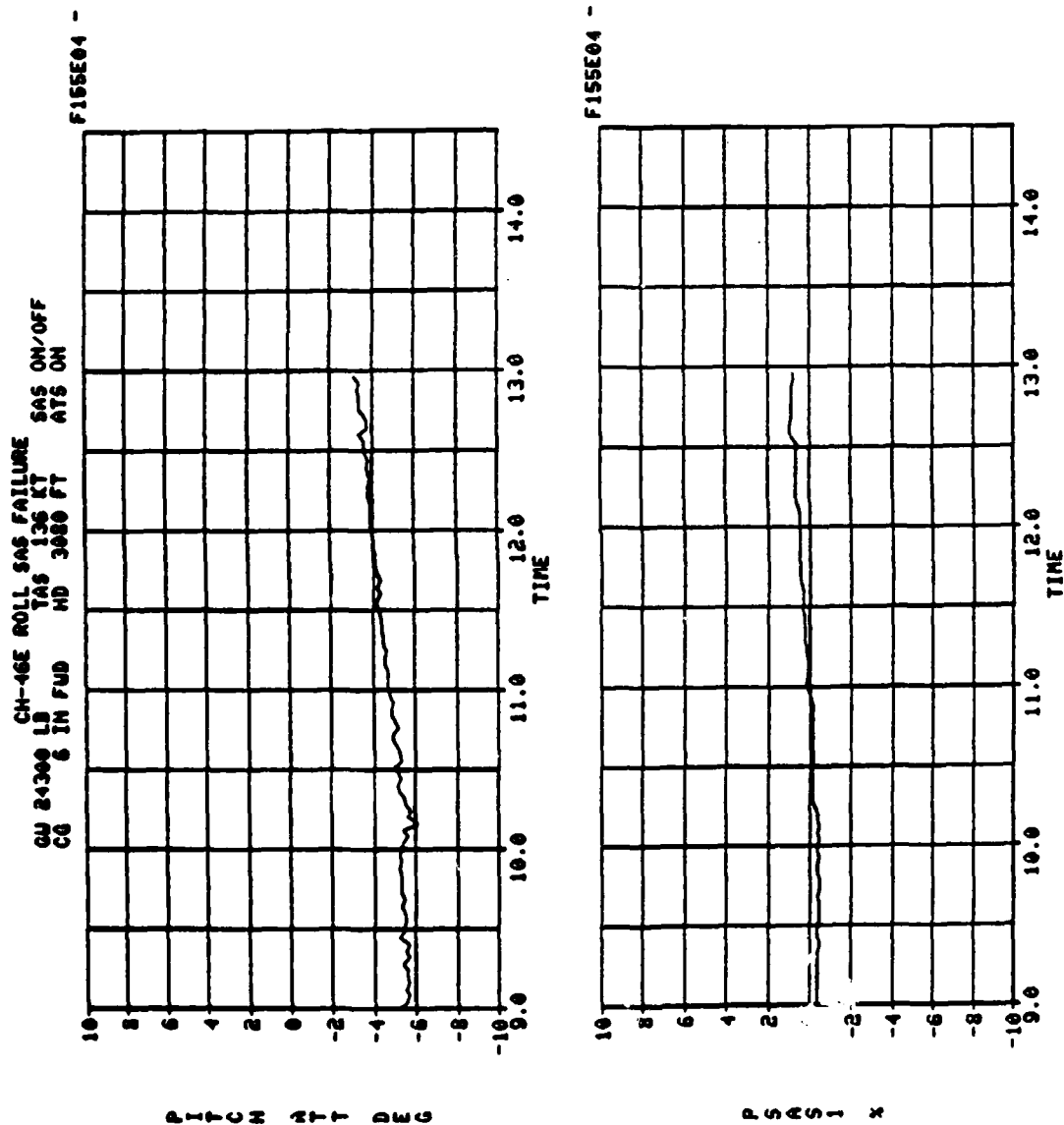


FIGURE 17G

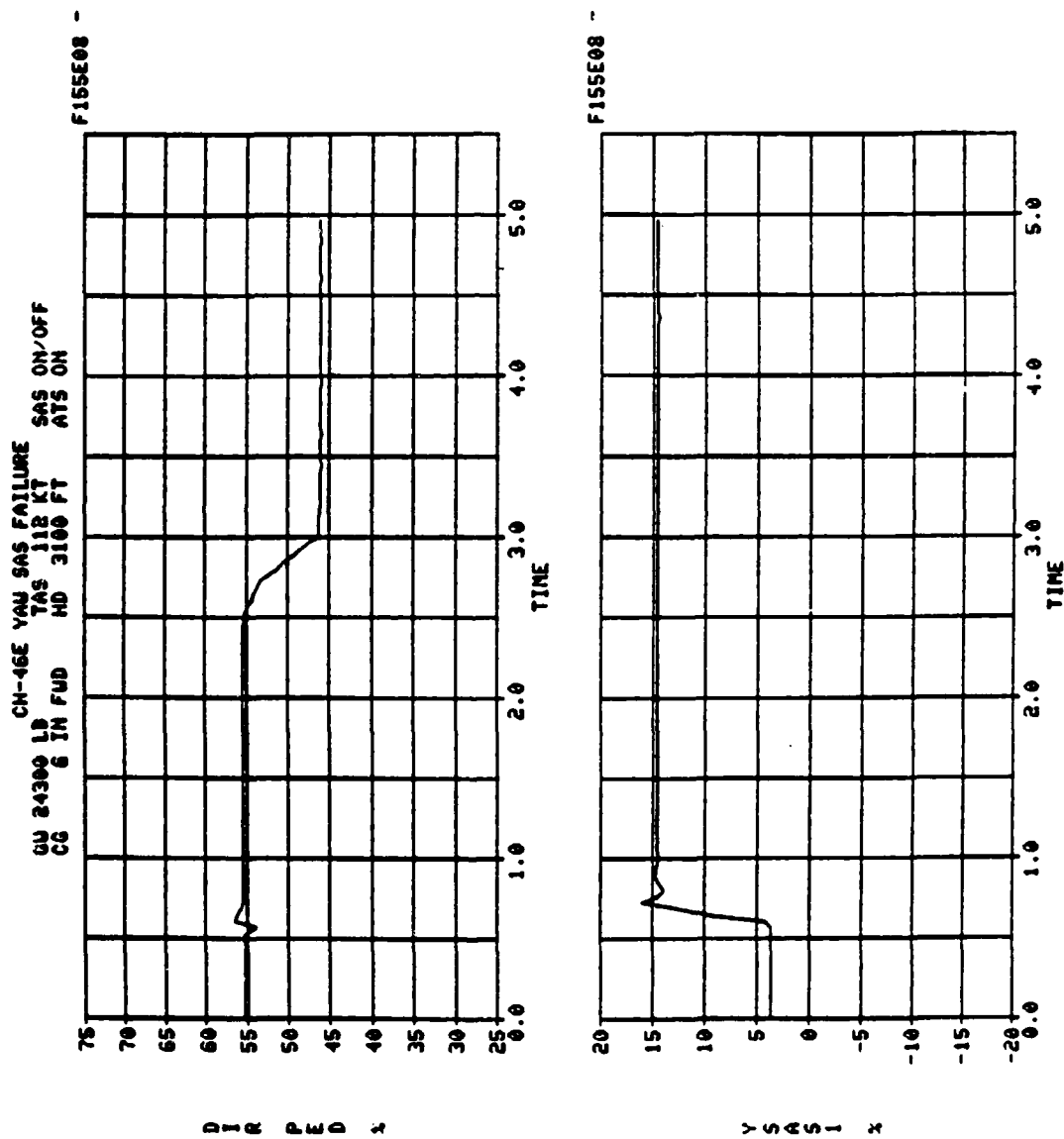


FIGURE 18A

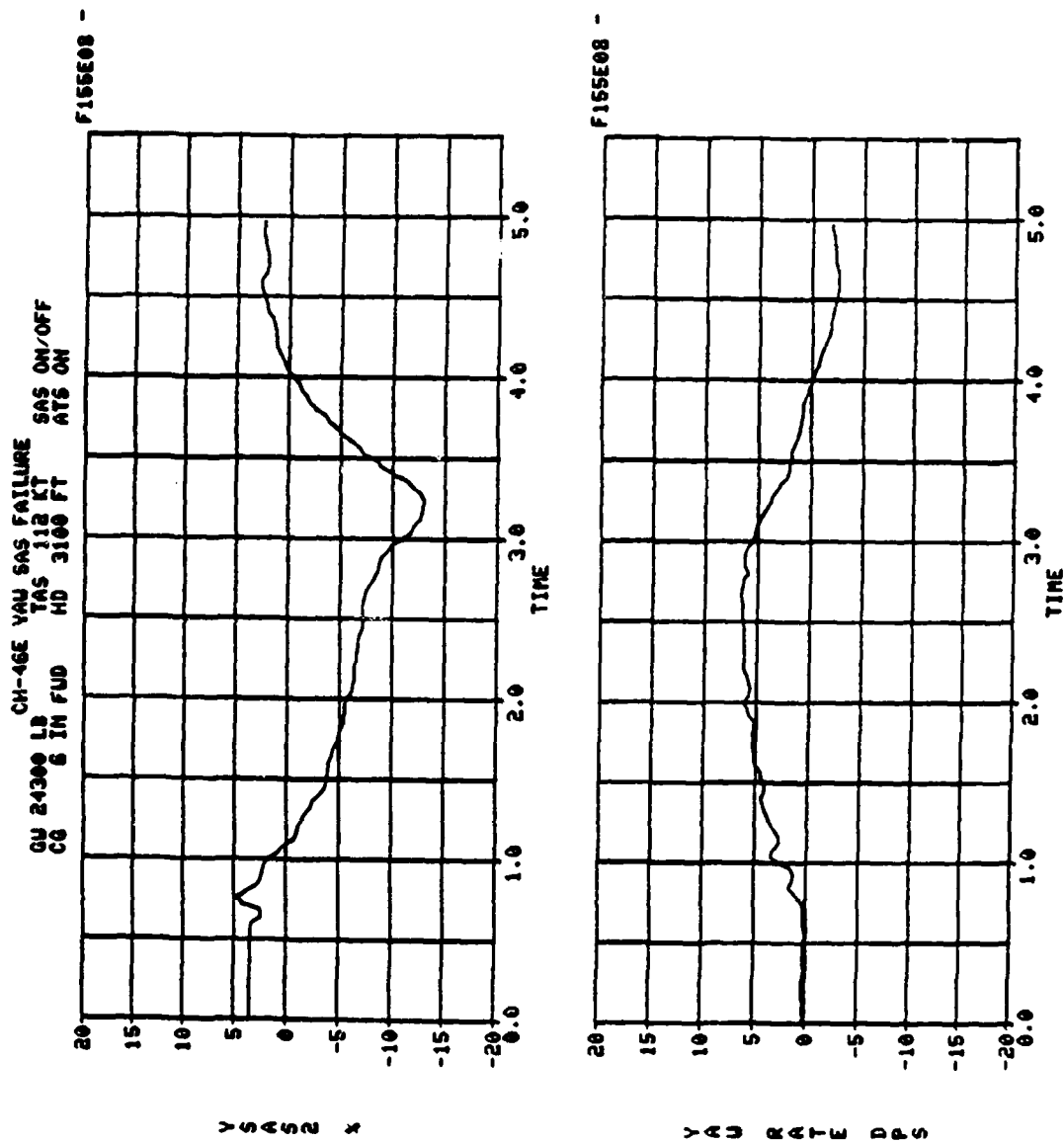


FIGURE 18B

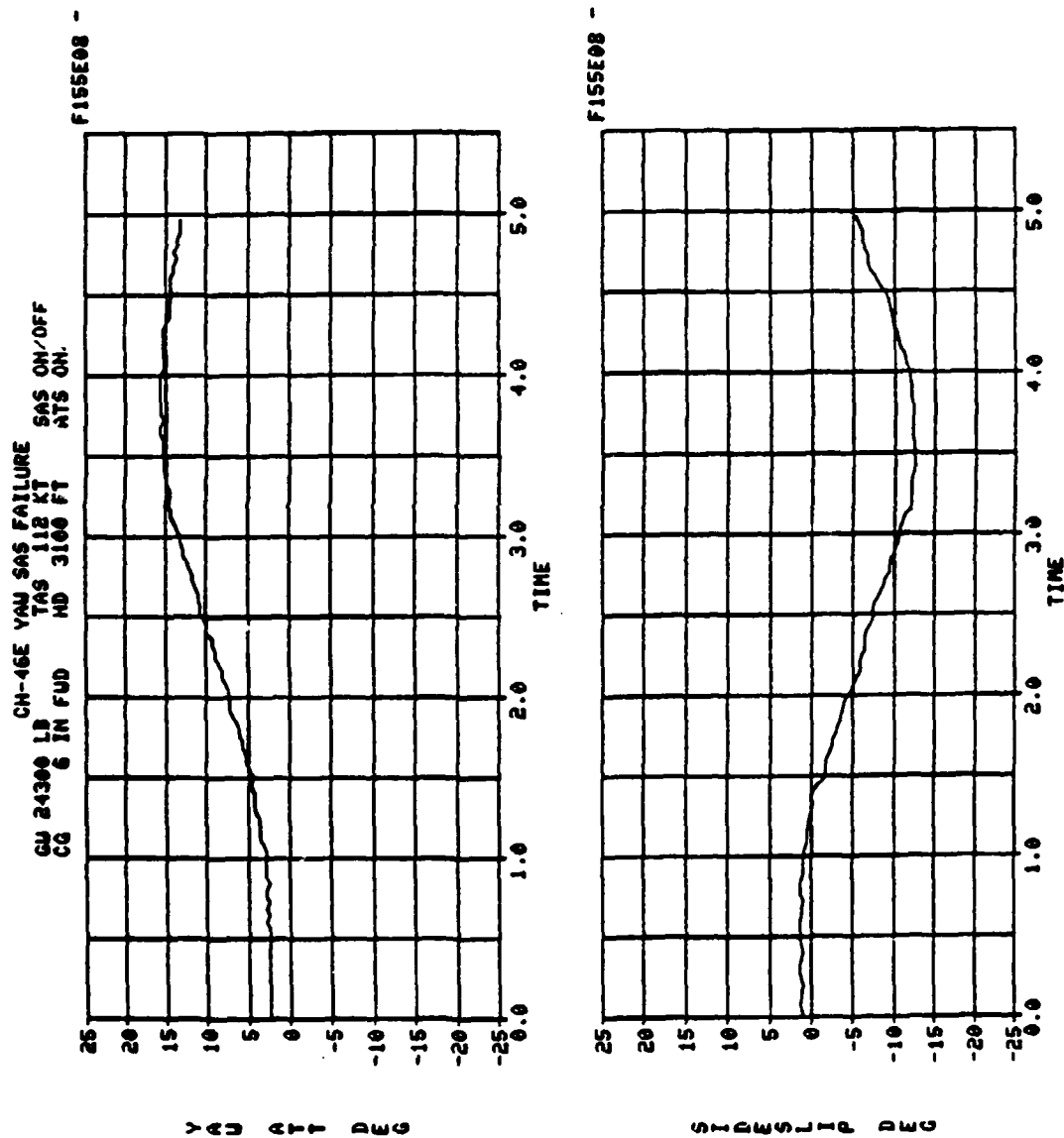


FIGURE 18C

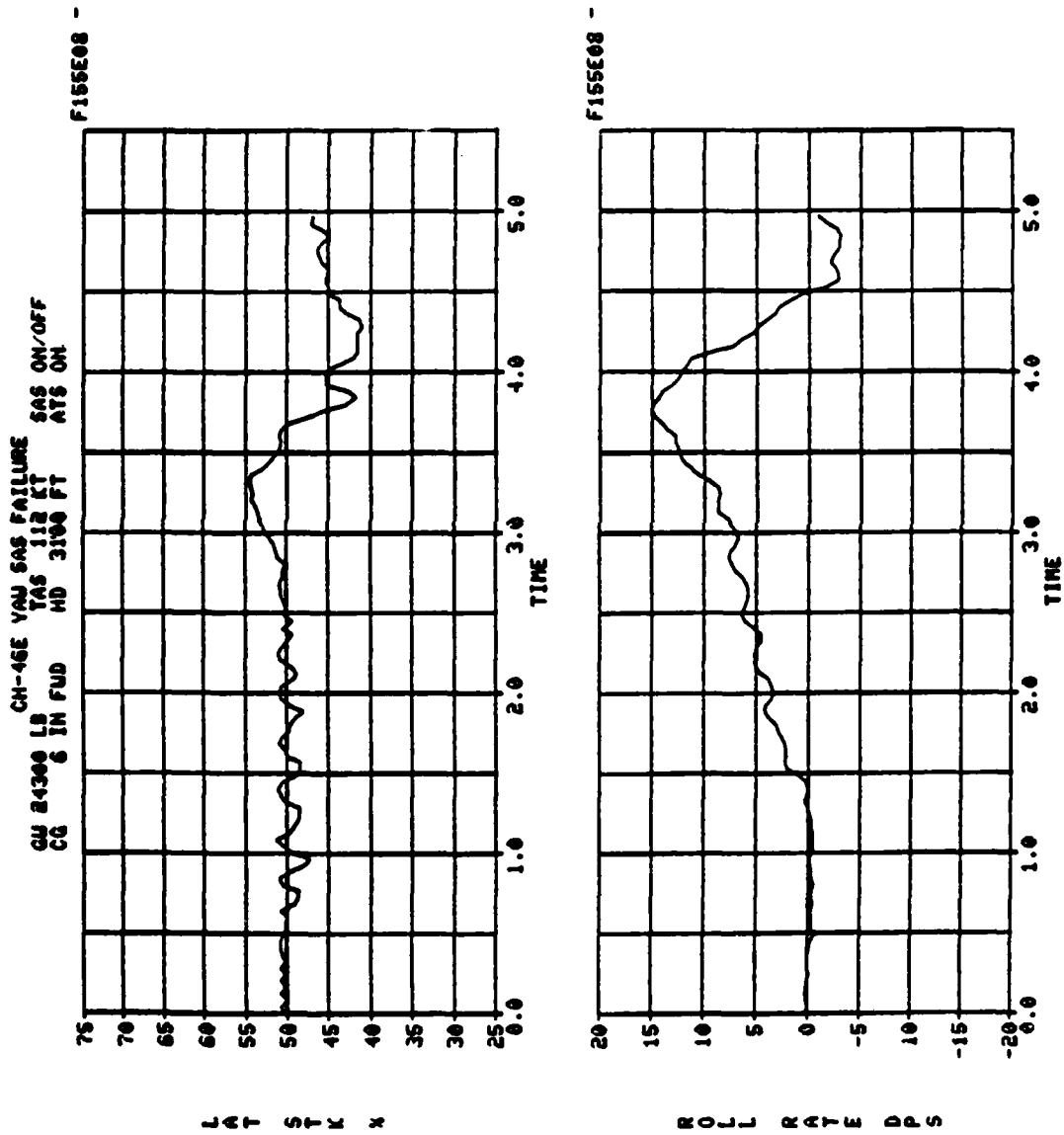


FIGURE 18D

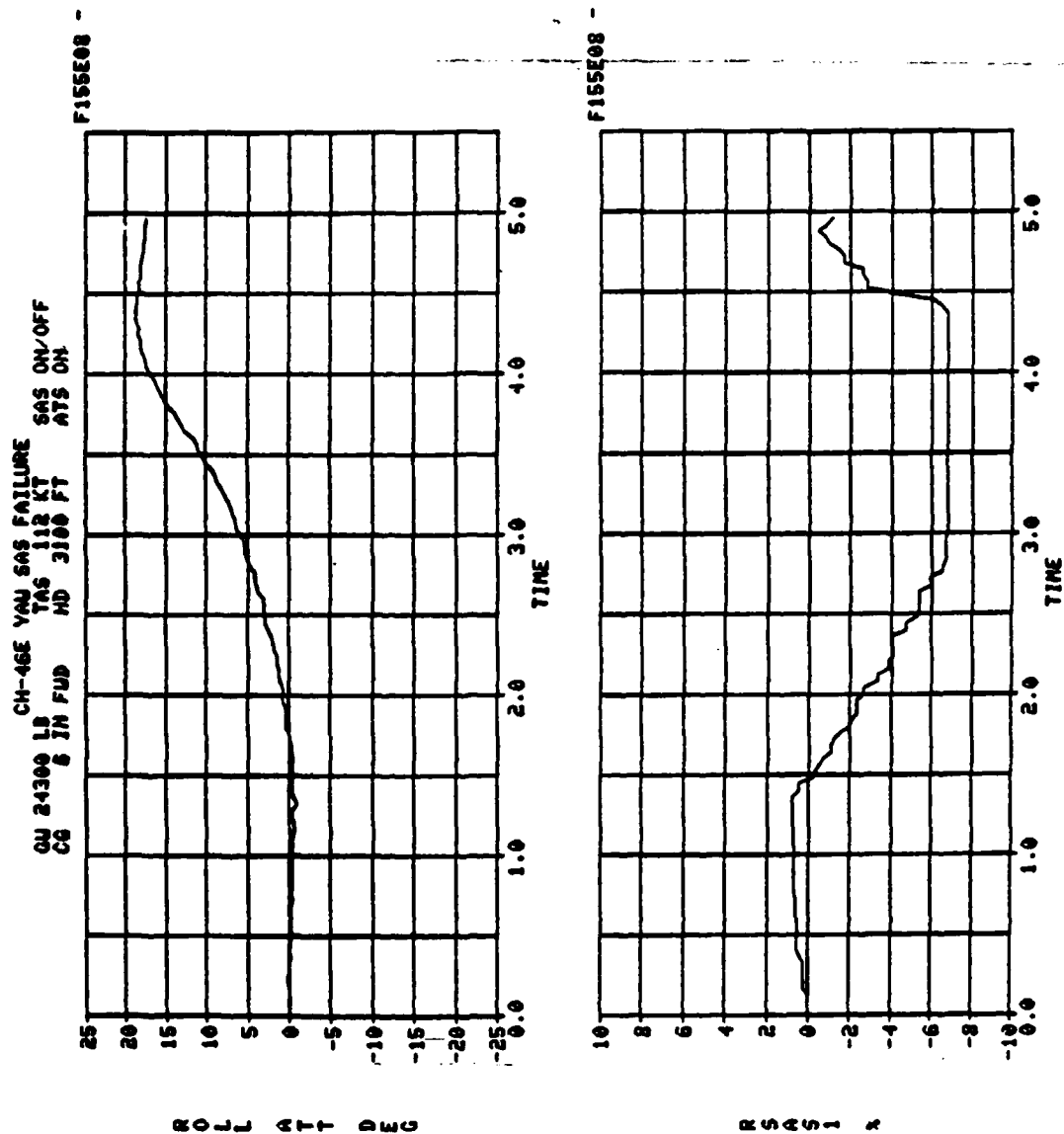


FIGURE 18E



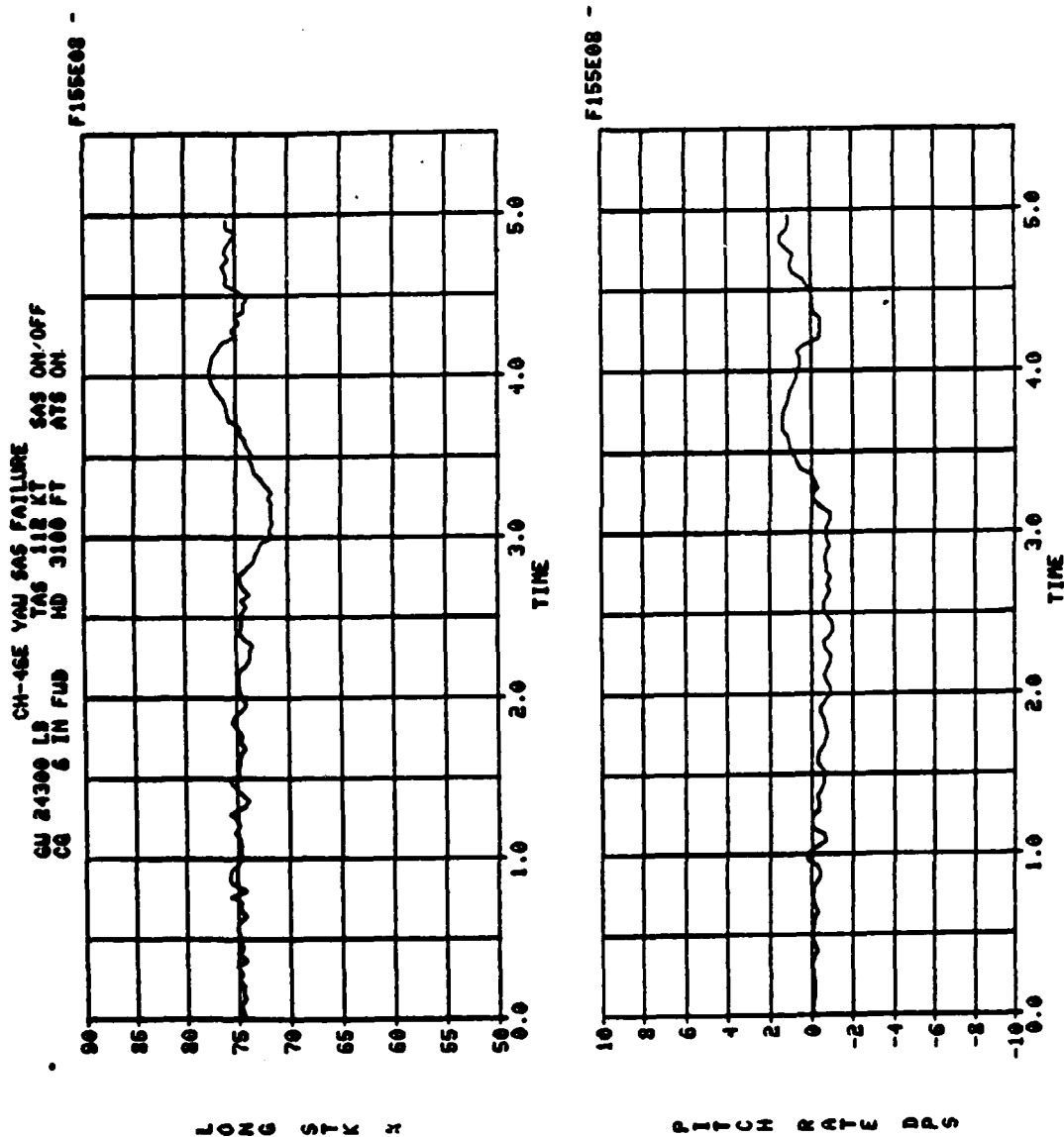


FIGURE 18F

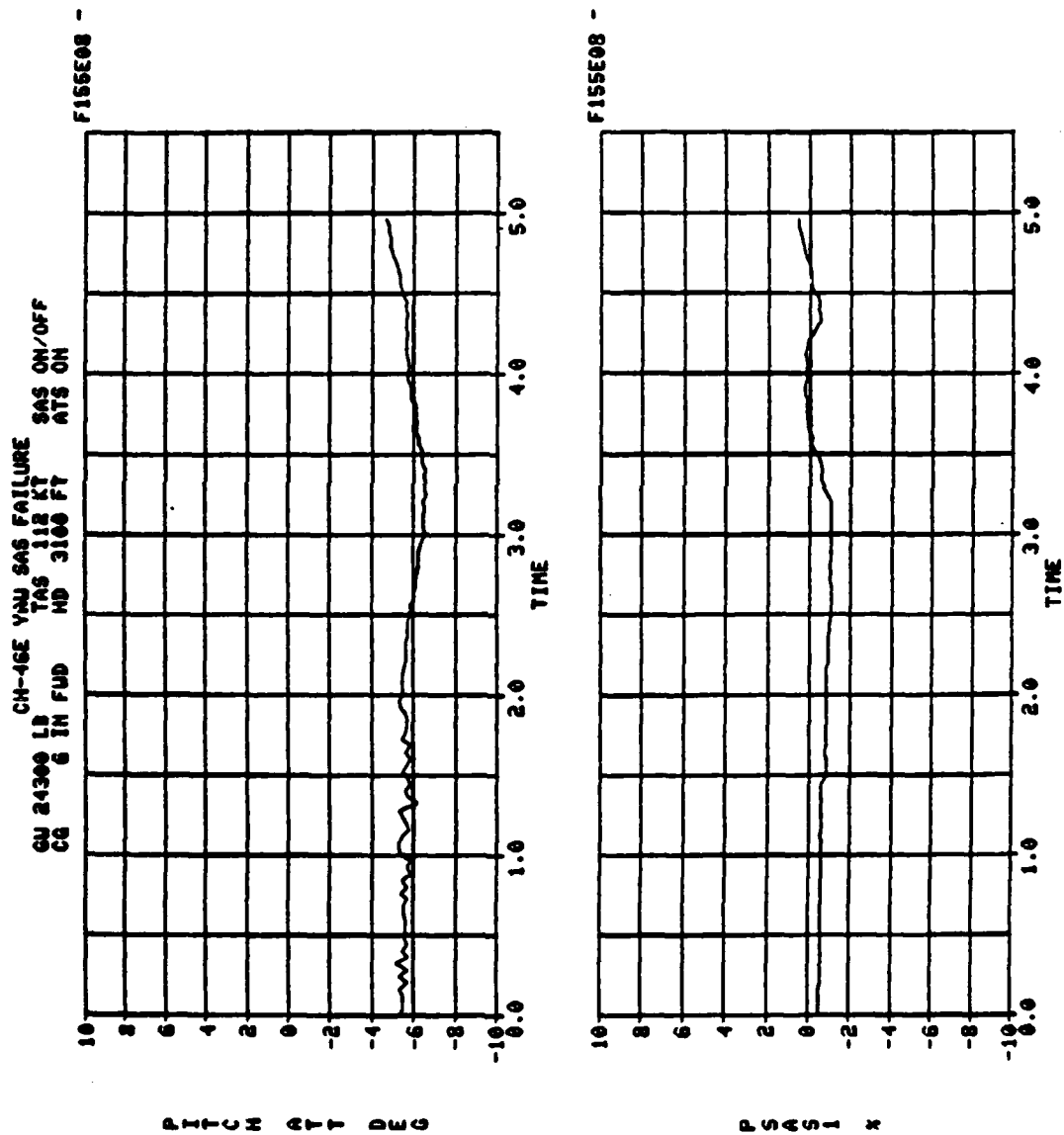


FIGURE 18G

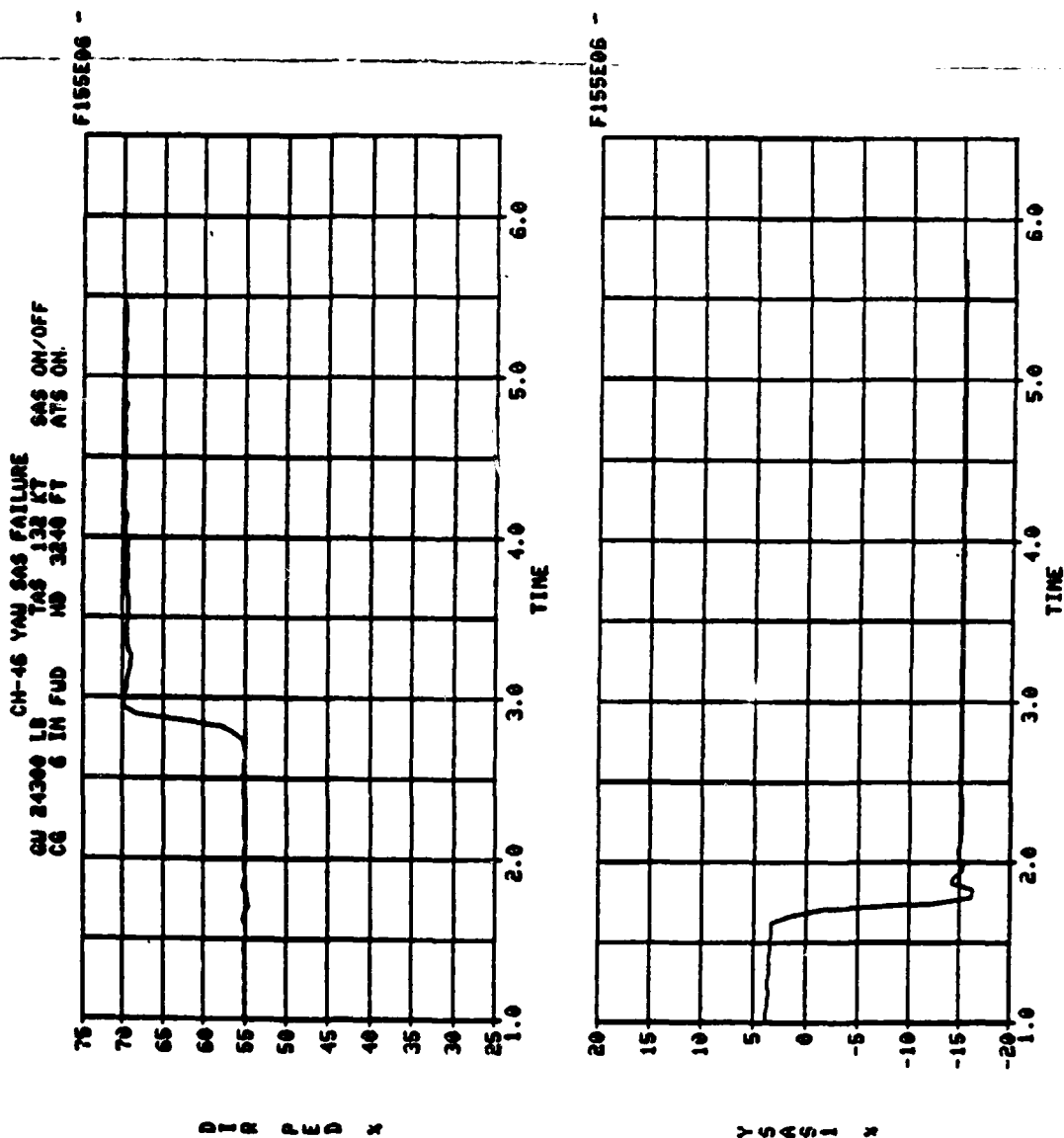


FIGURE 19A

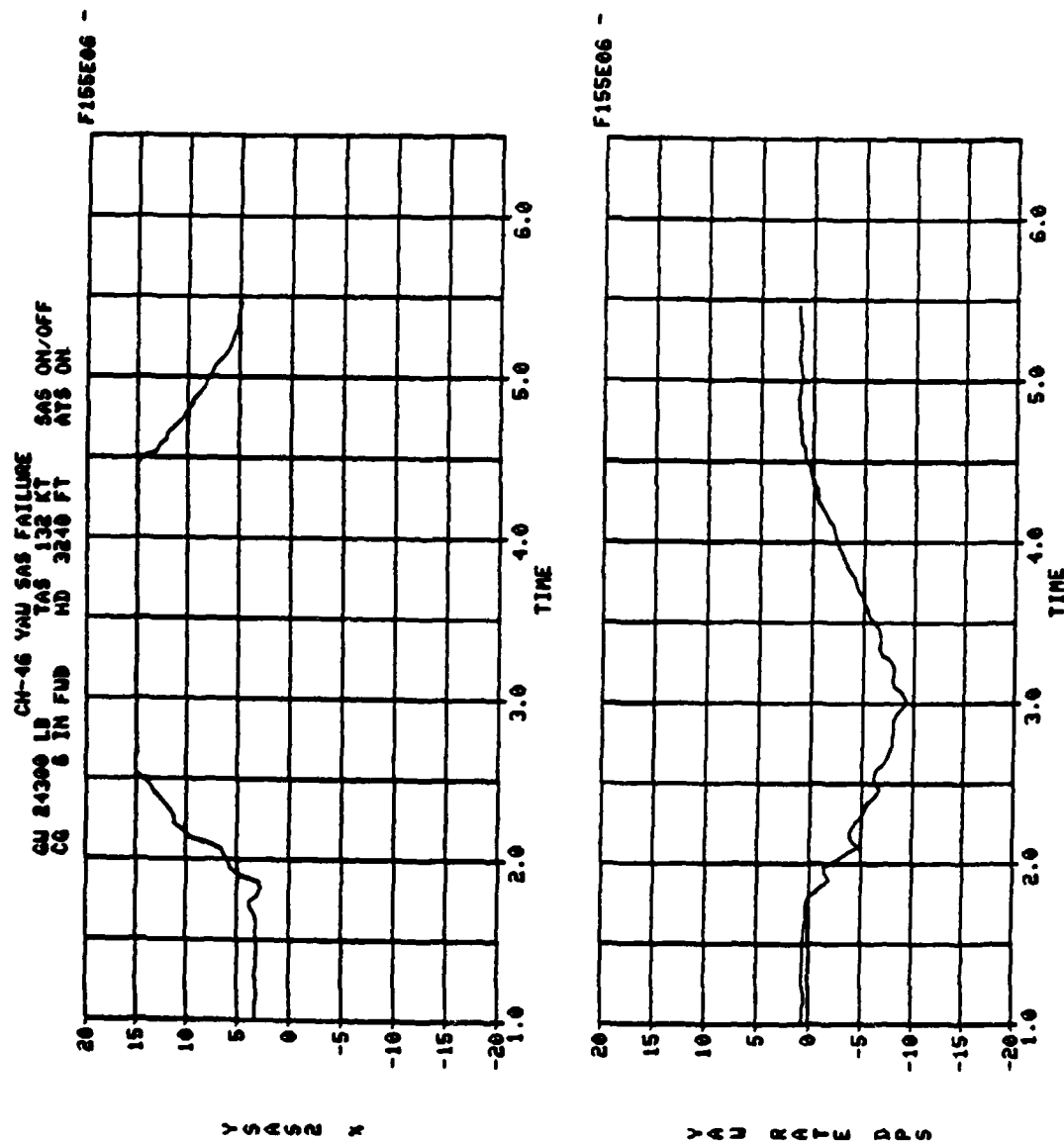


FIGURE 198

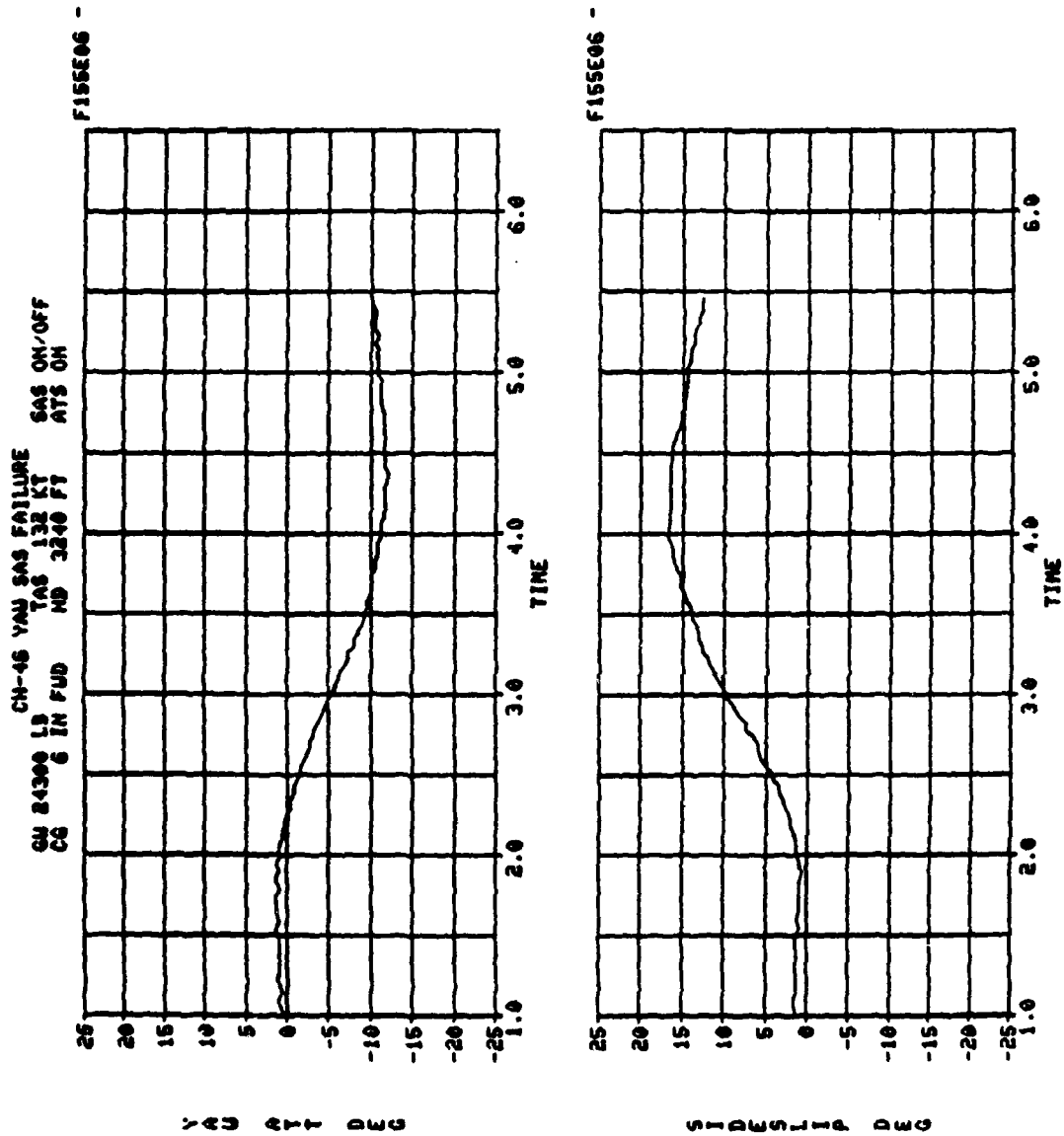


FIGURE 19C

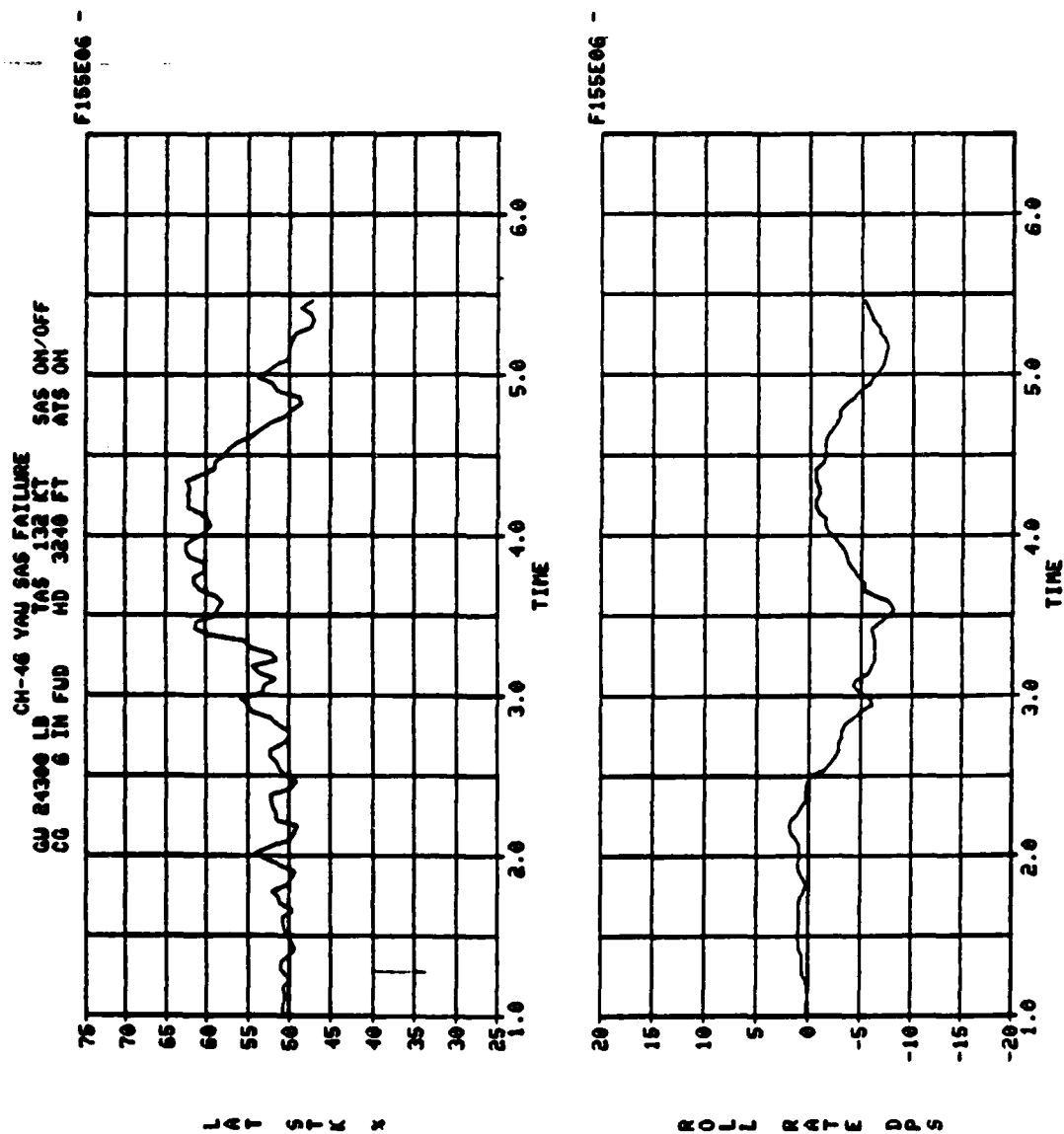


FIGURE 19D

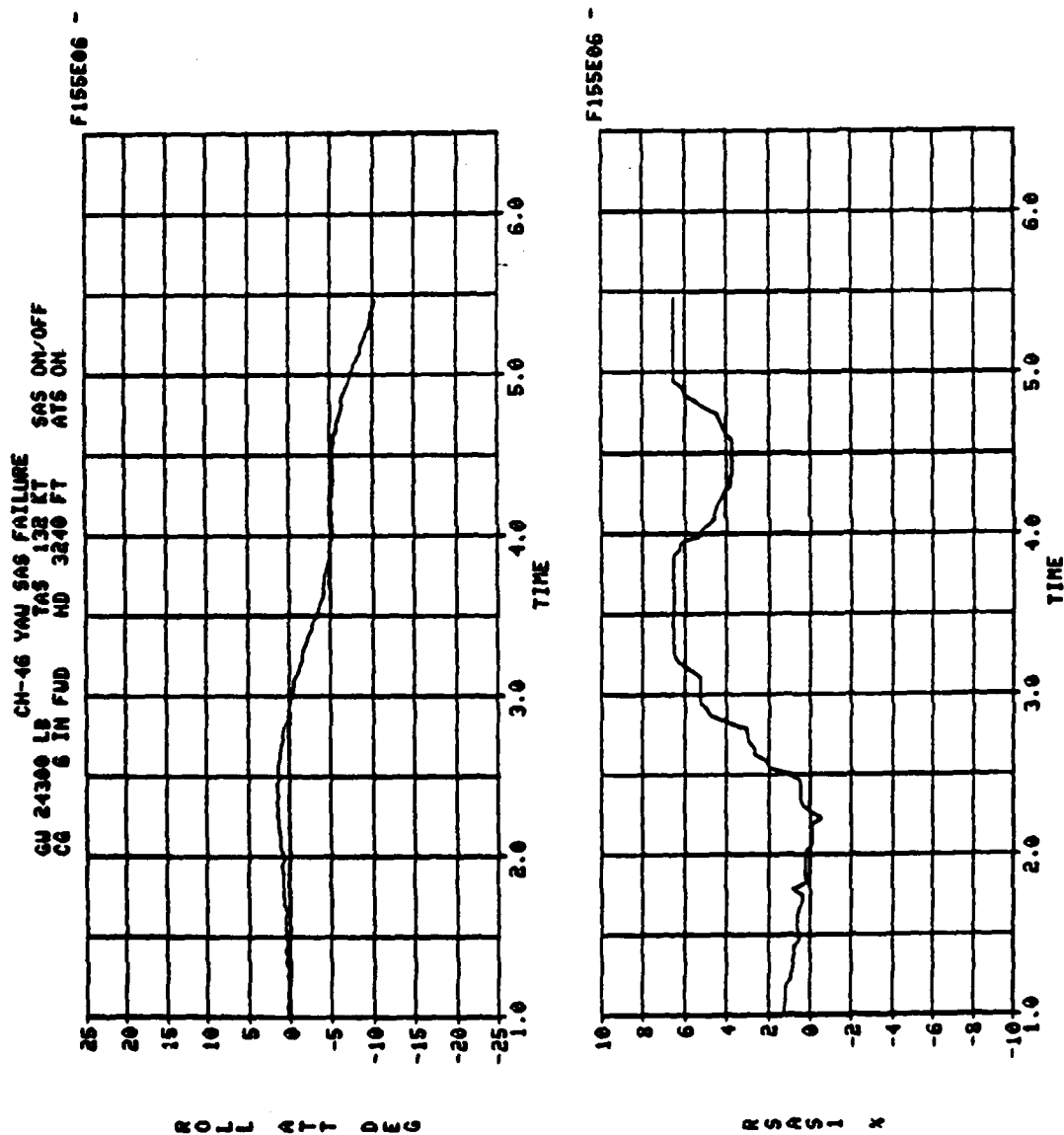


FIGURE 19E

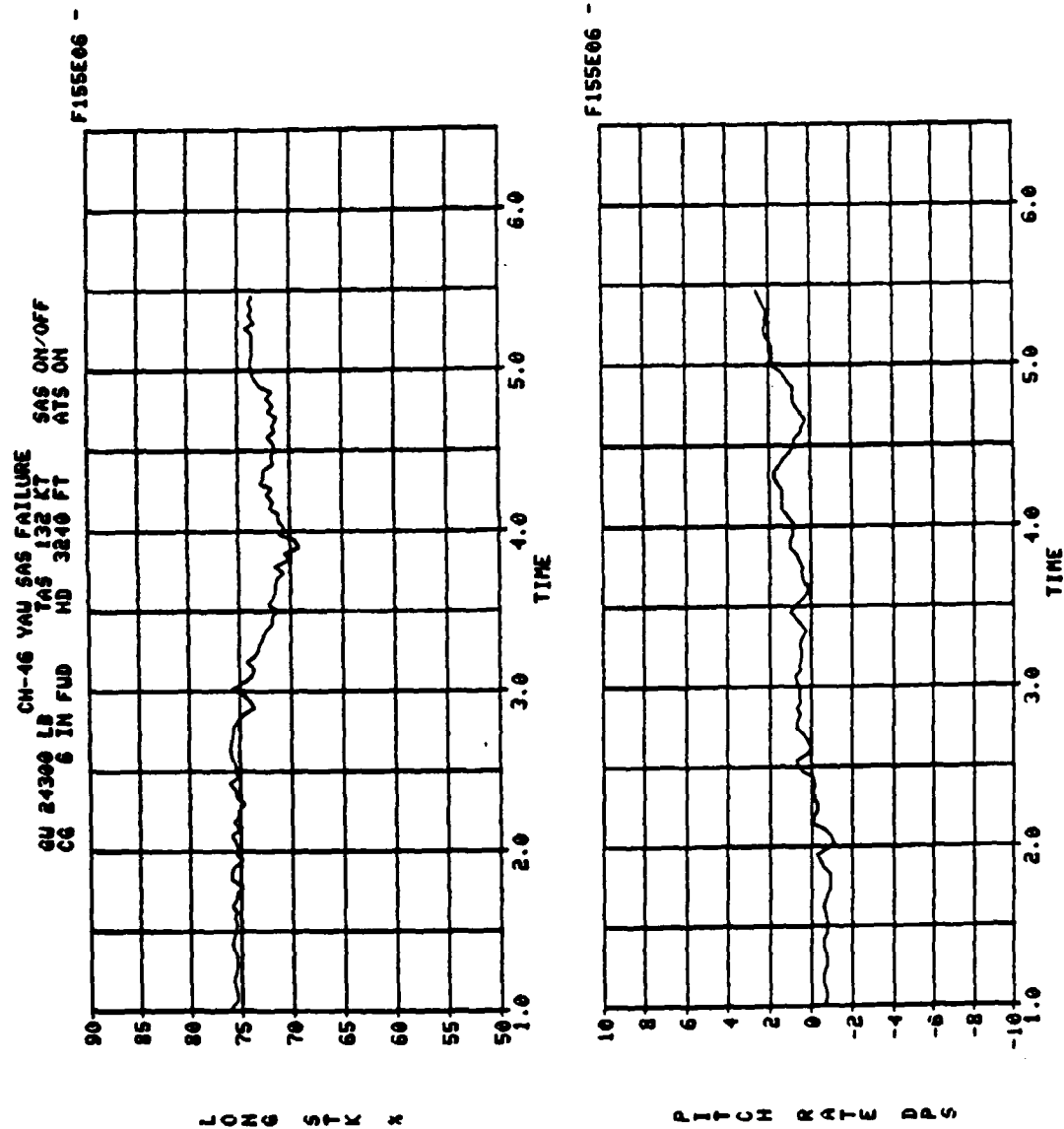


FIGURE 19F



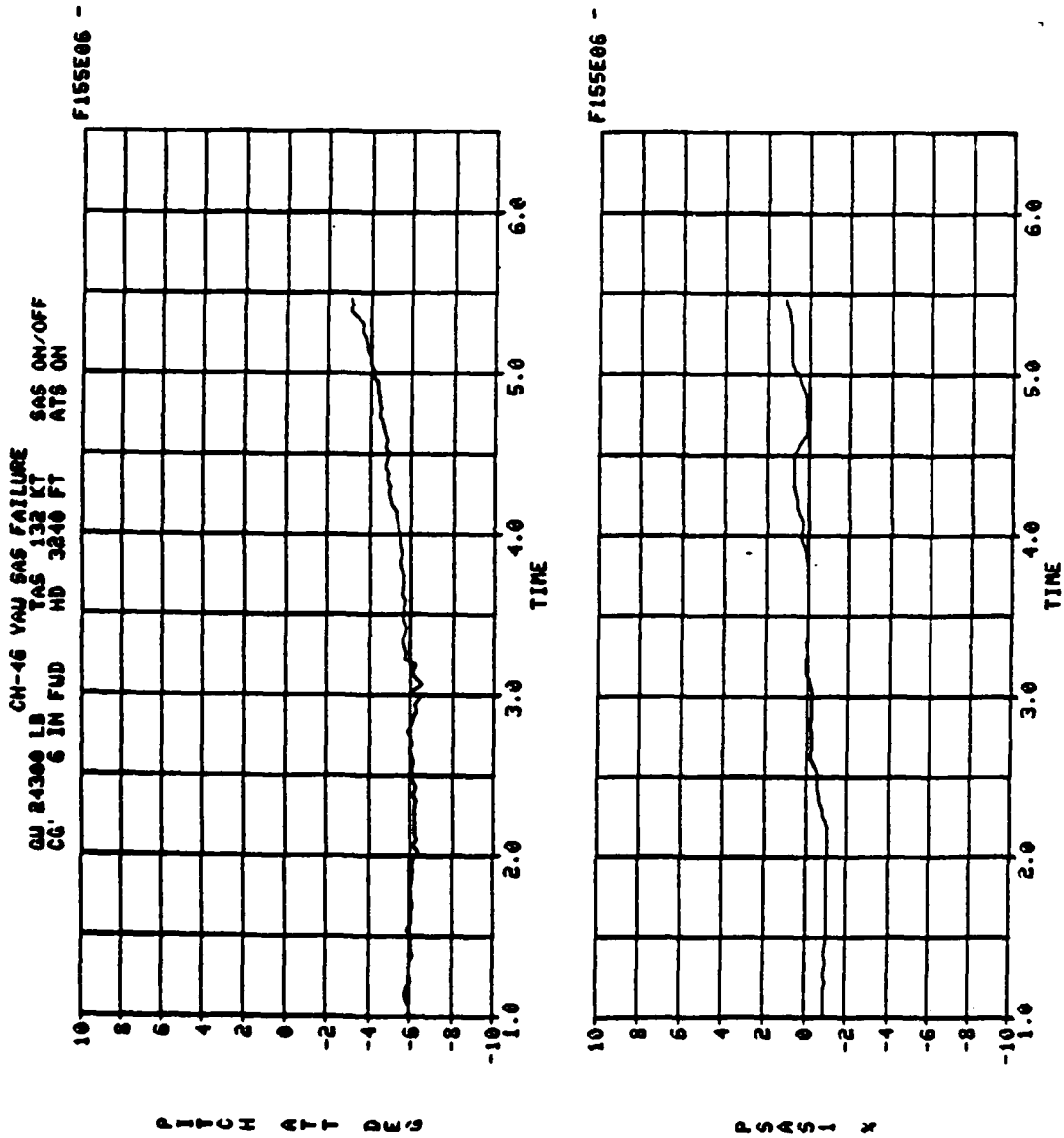


FIGURE 19G

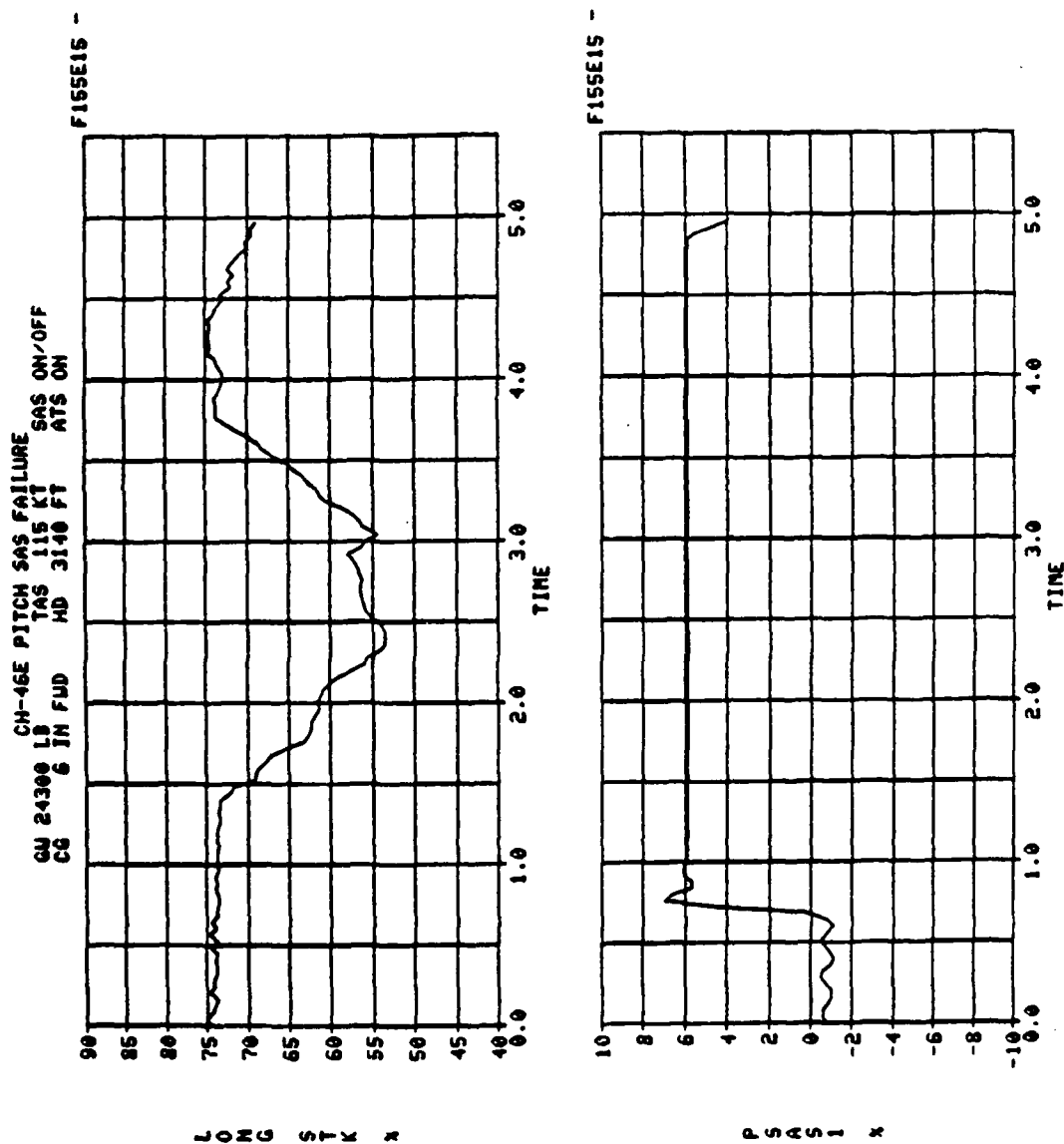


FIGURE 20A

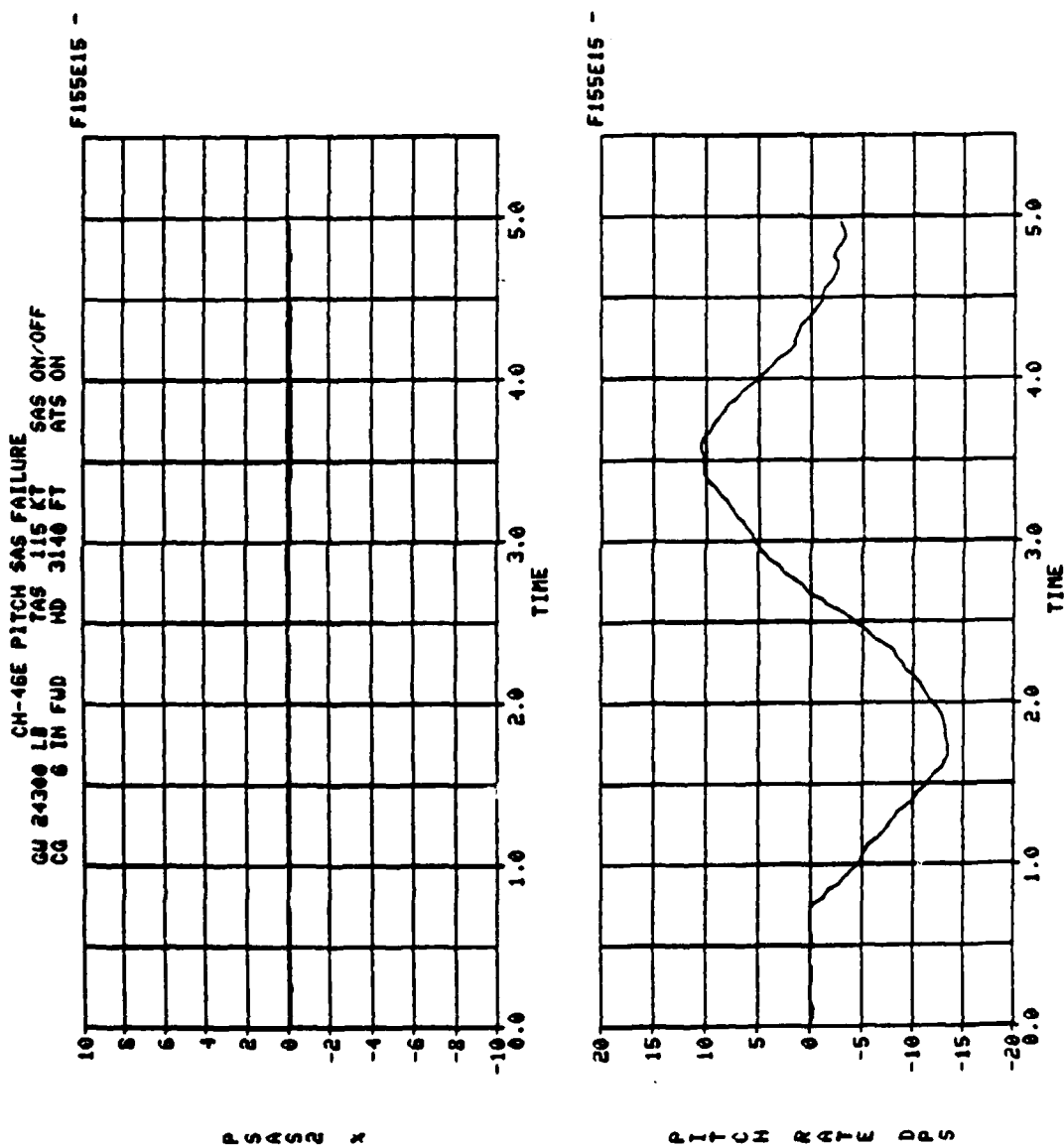
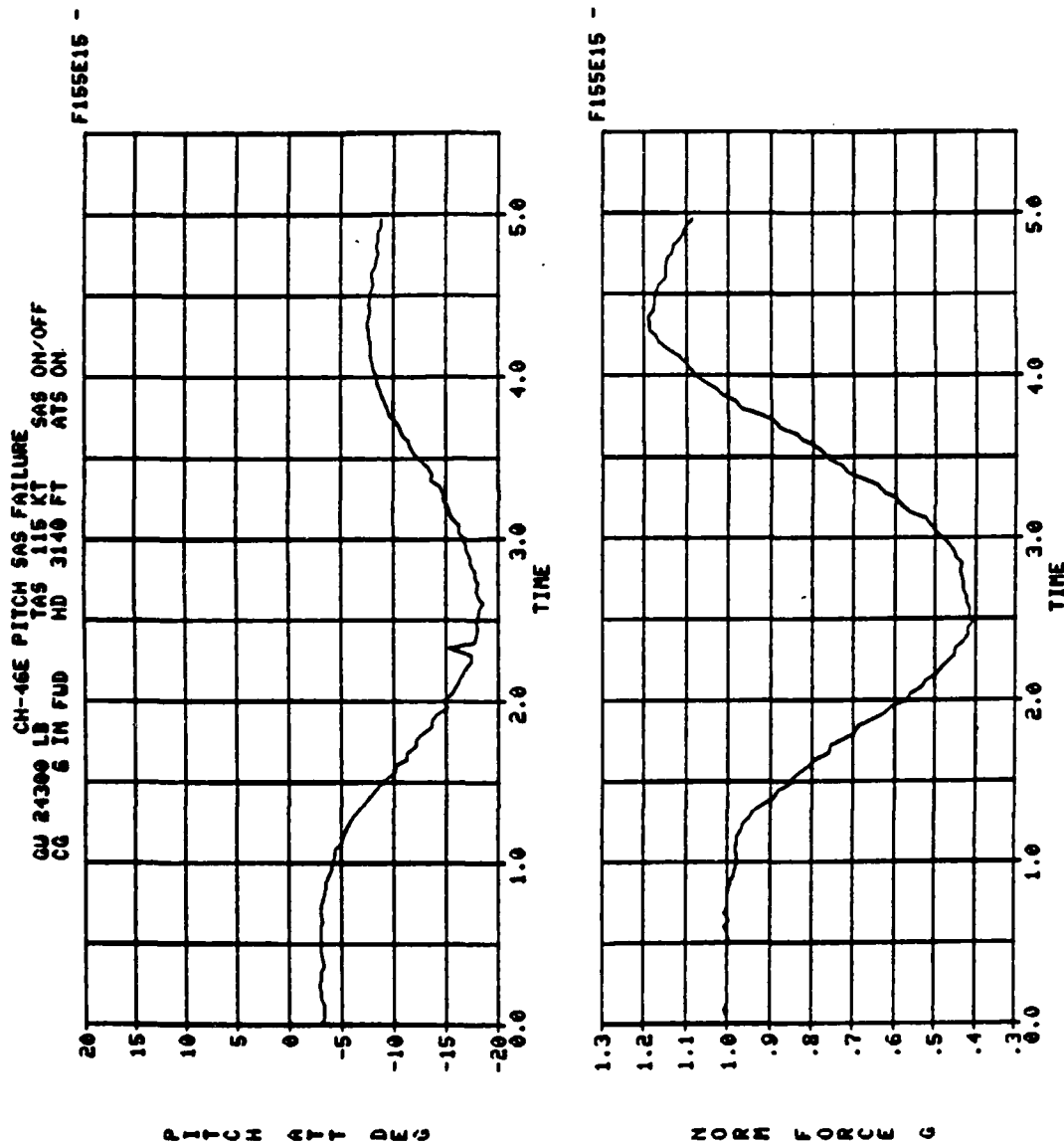


FIGURE 20B



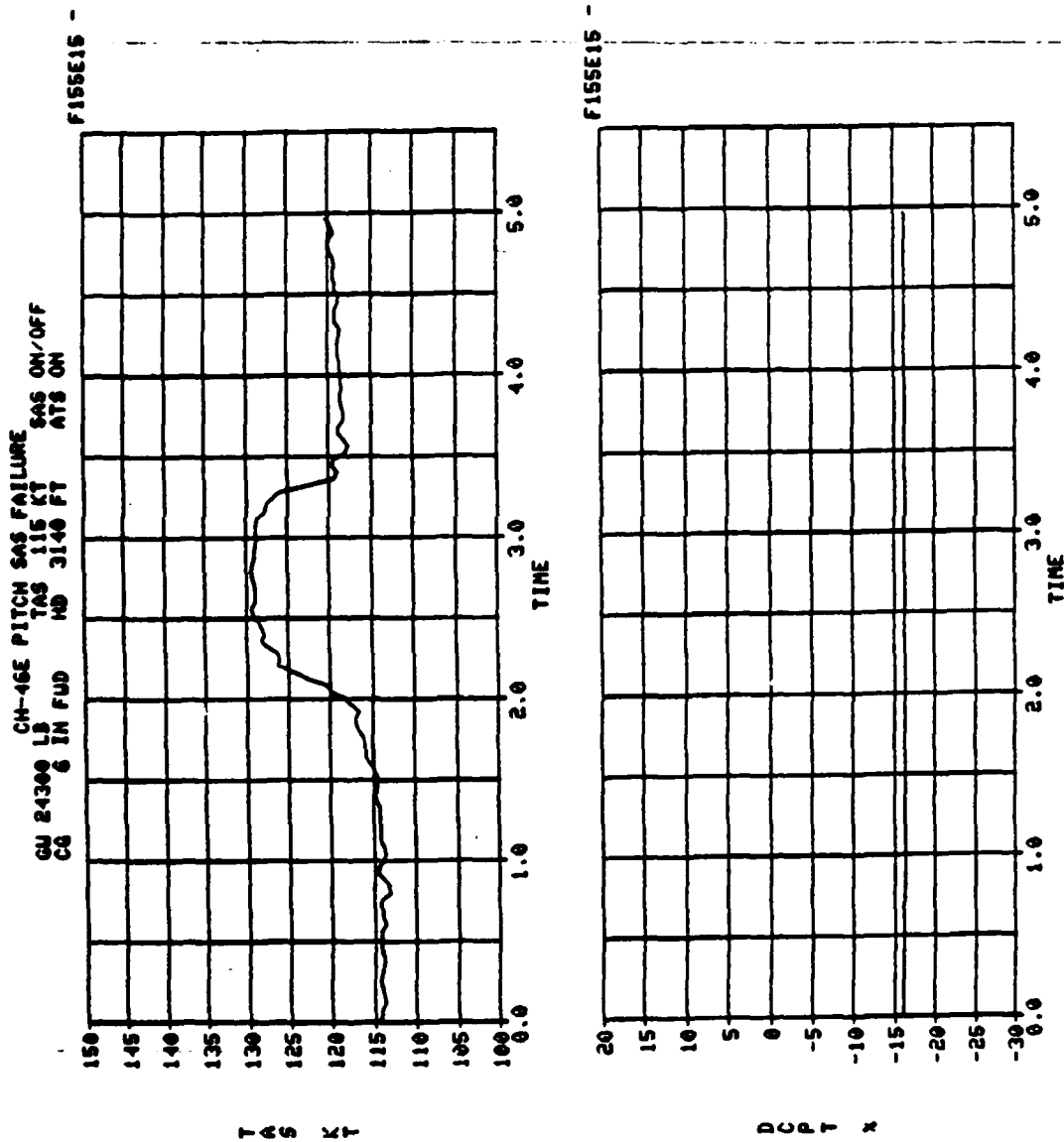


FIGURE 200

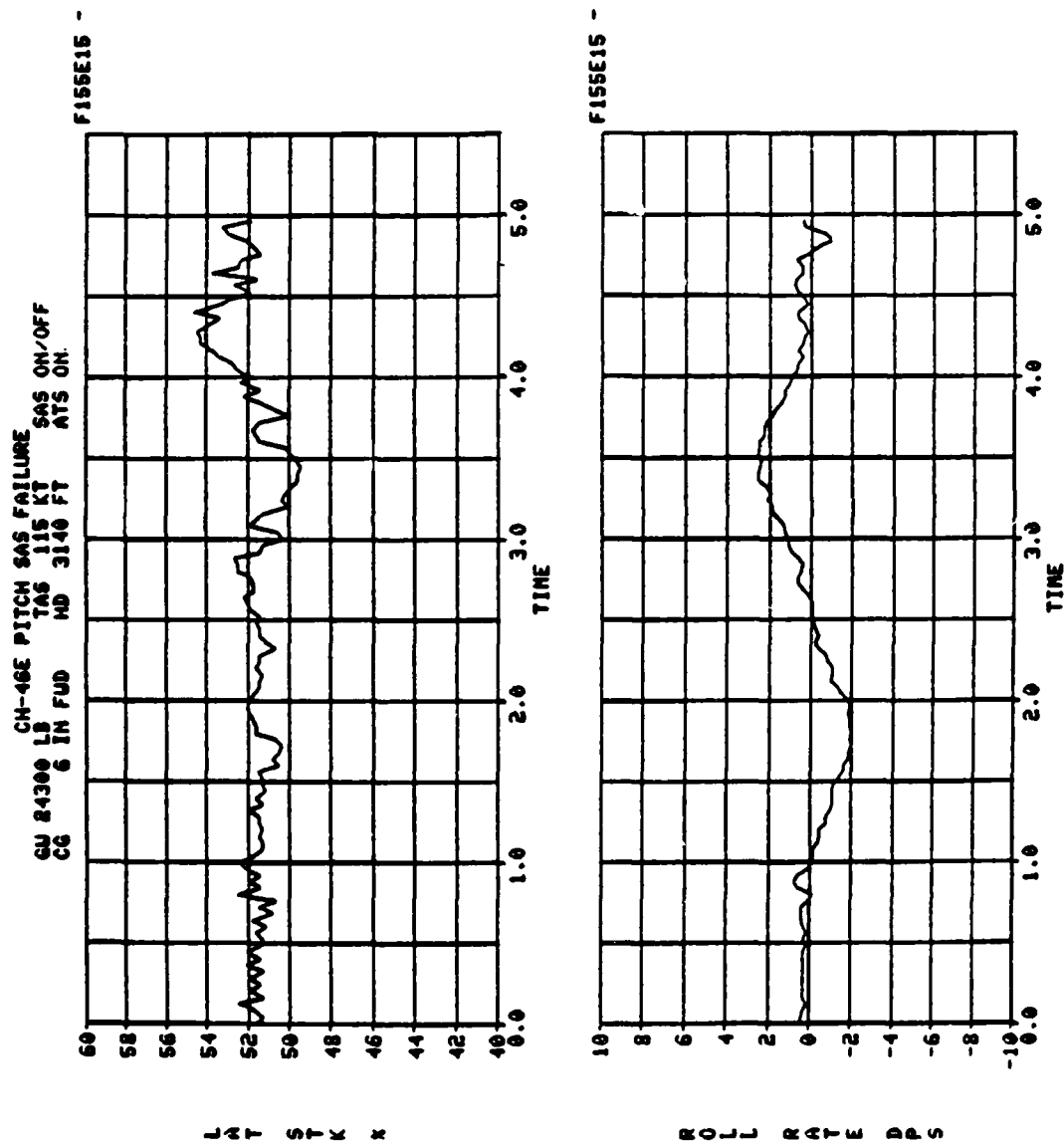


FIGURE 20E

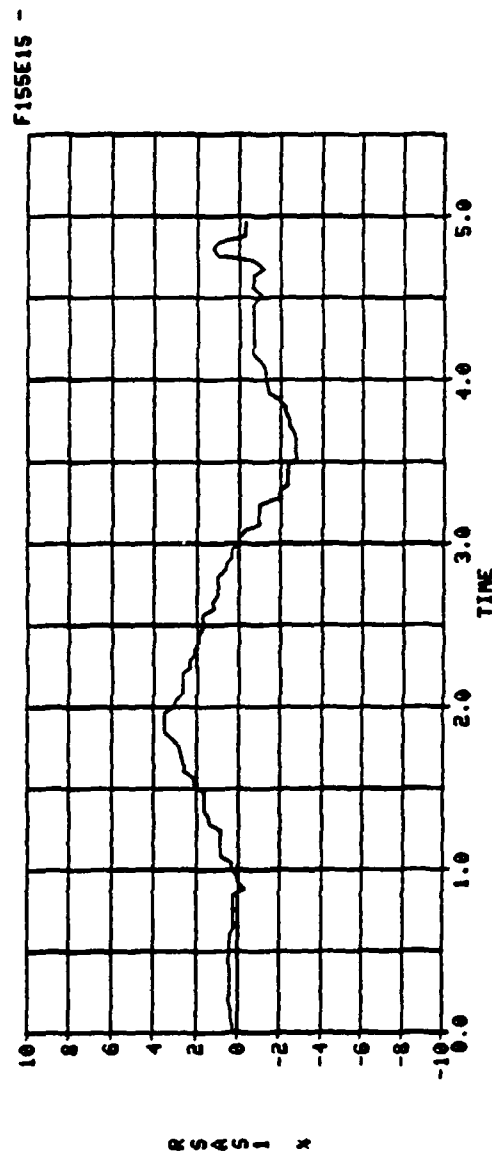
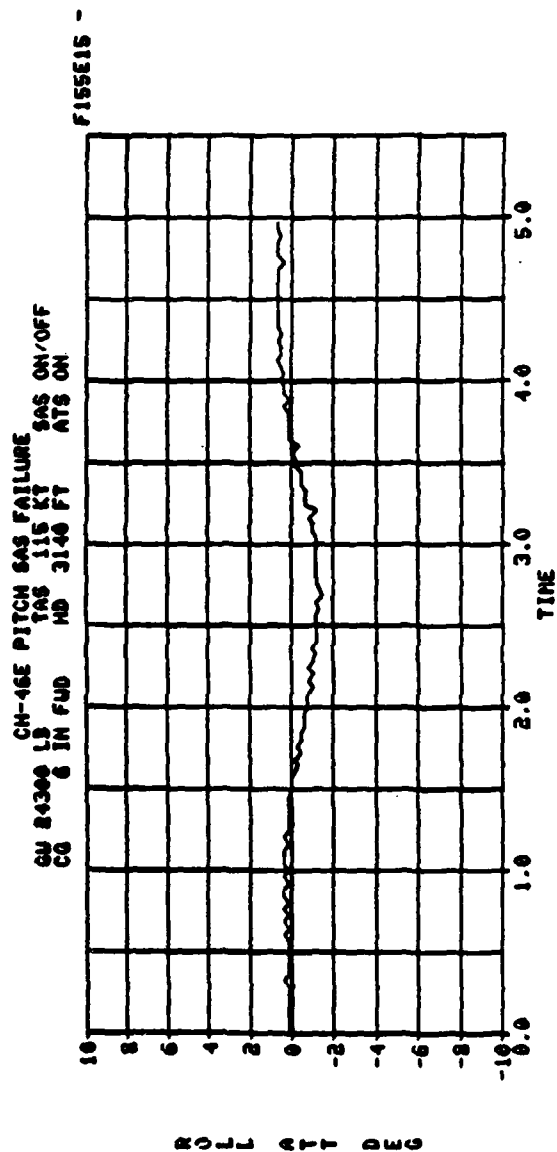


FIGURE 20F

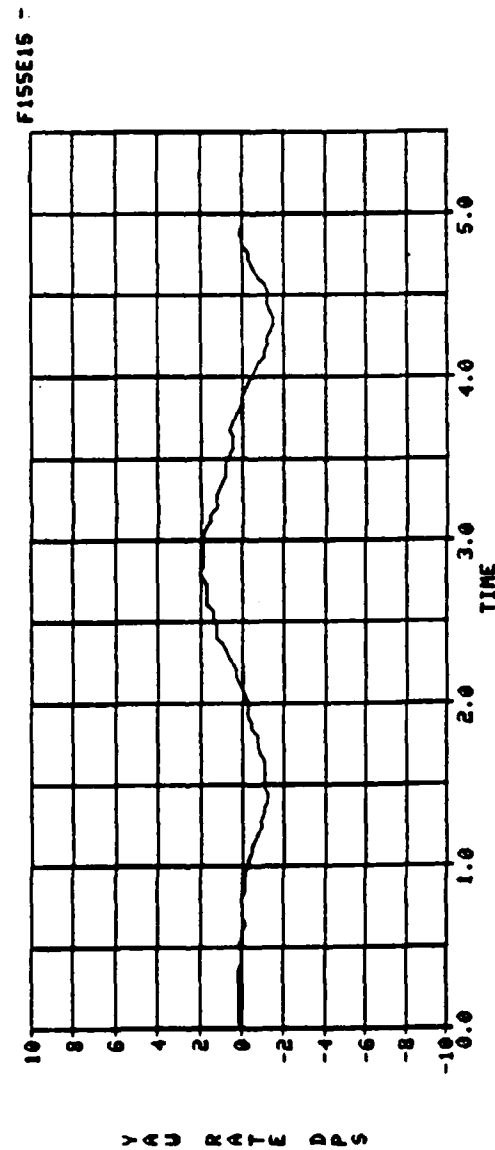
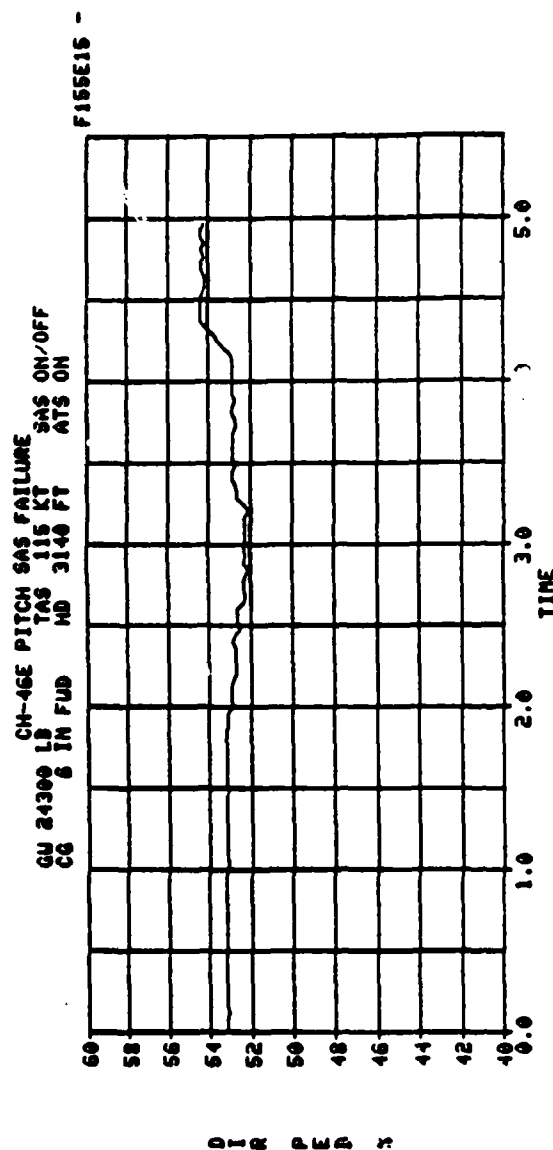


FIGURE 20G



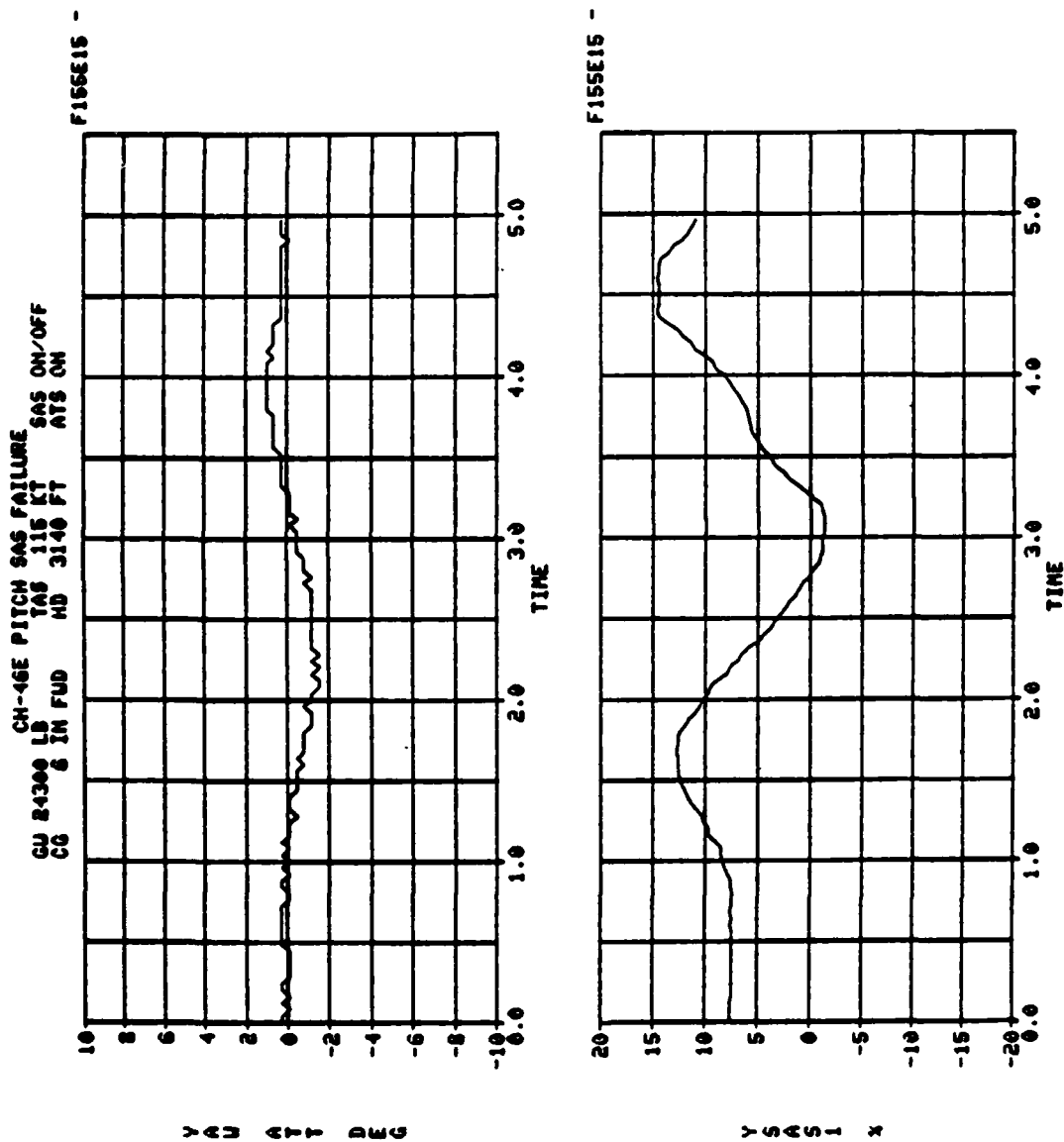


FIGURE 20H

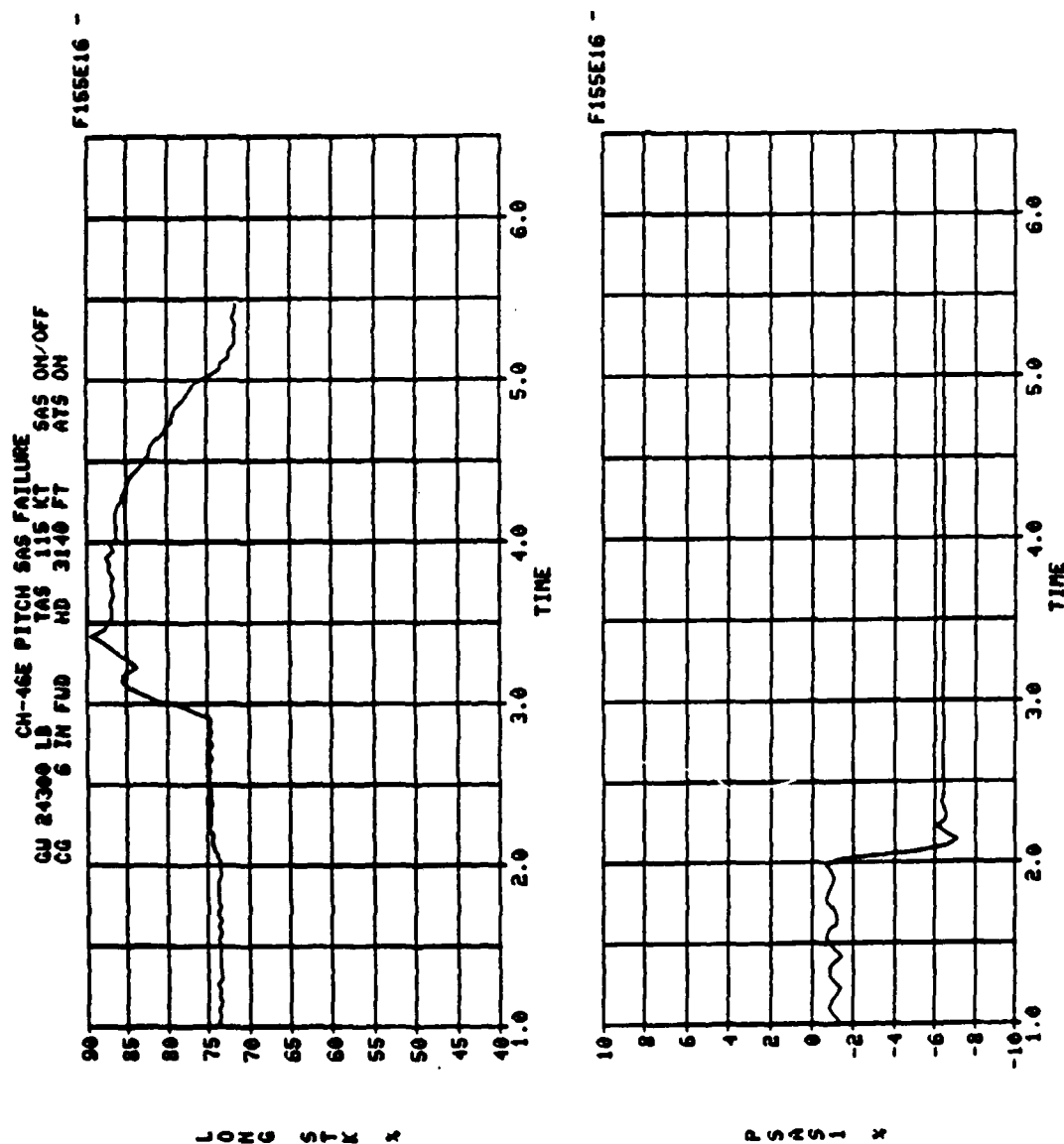


FIGURE 21A

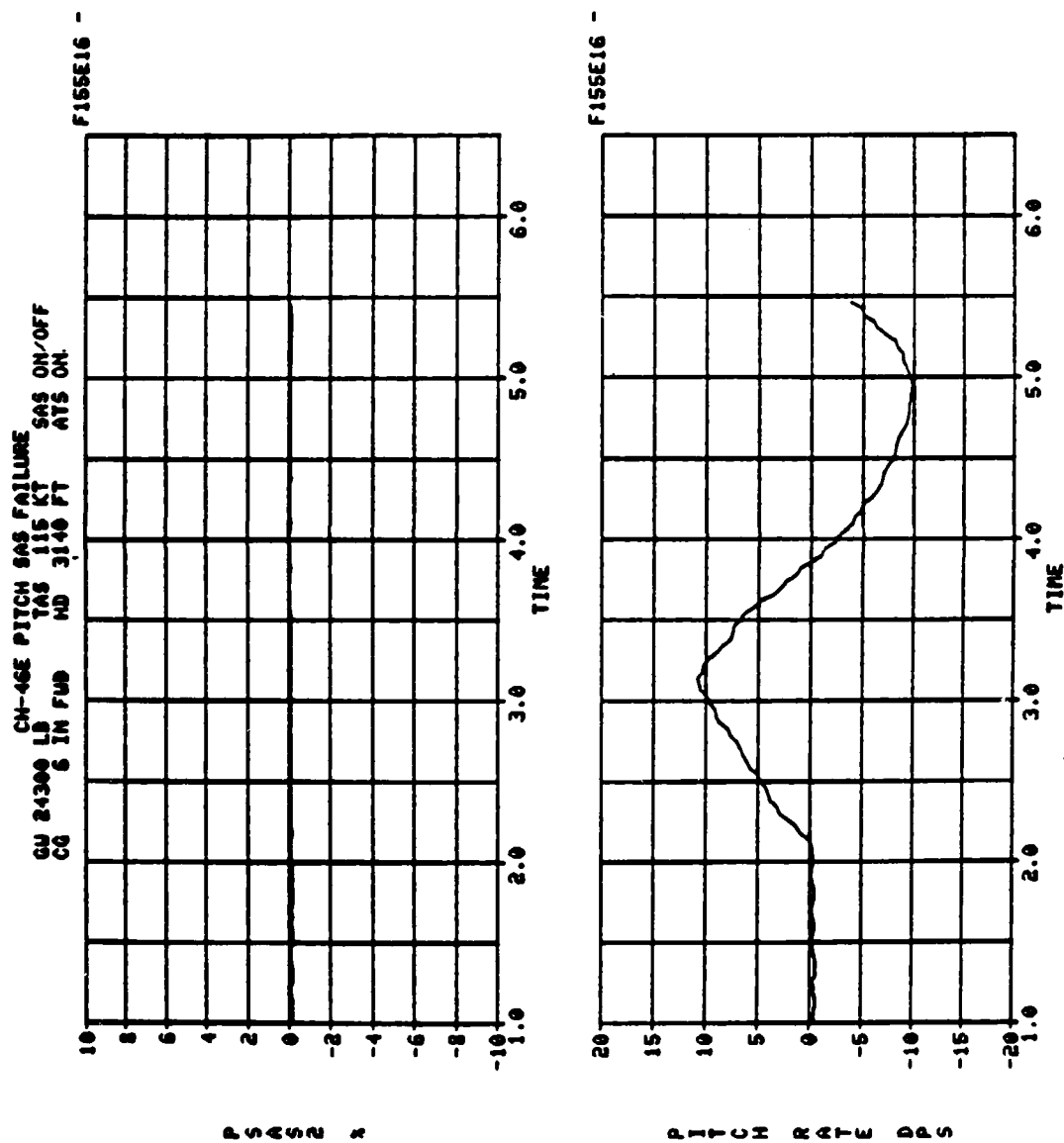


FIGURE 21B

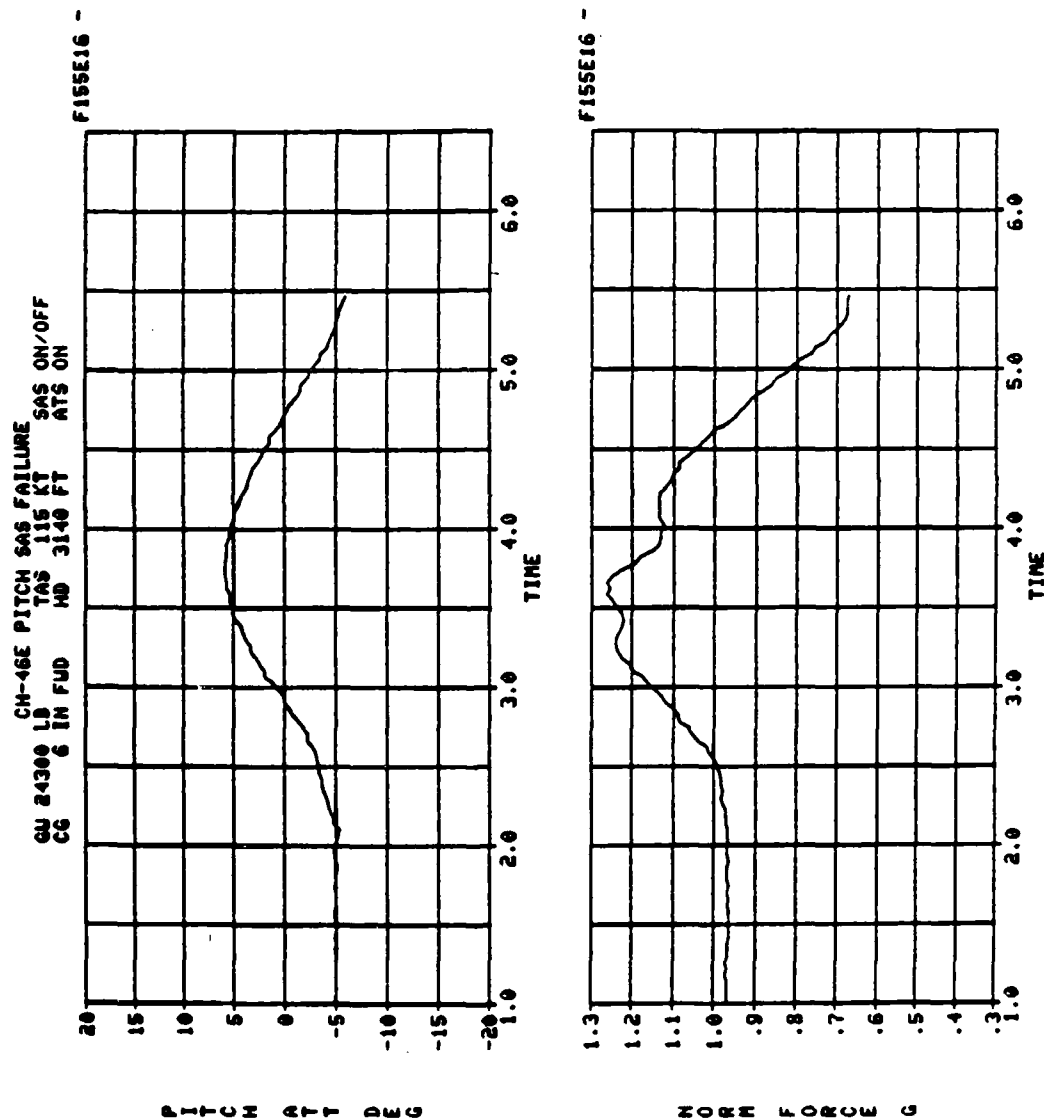


FIGURE 21C

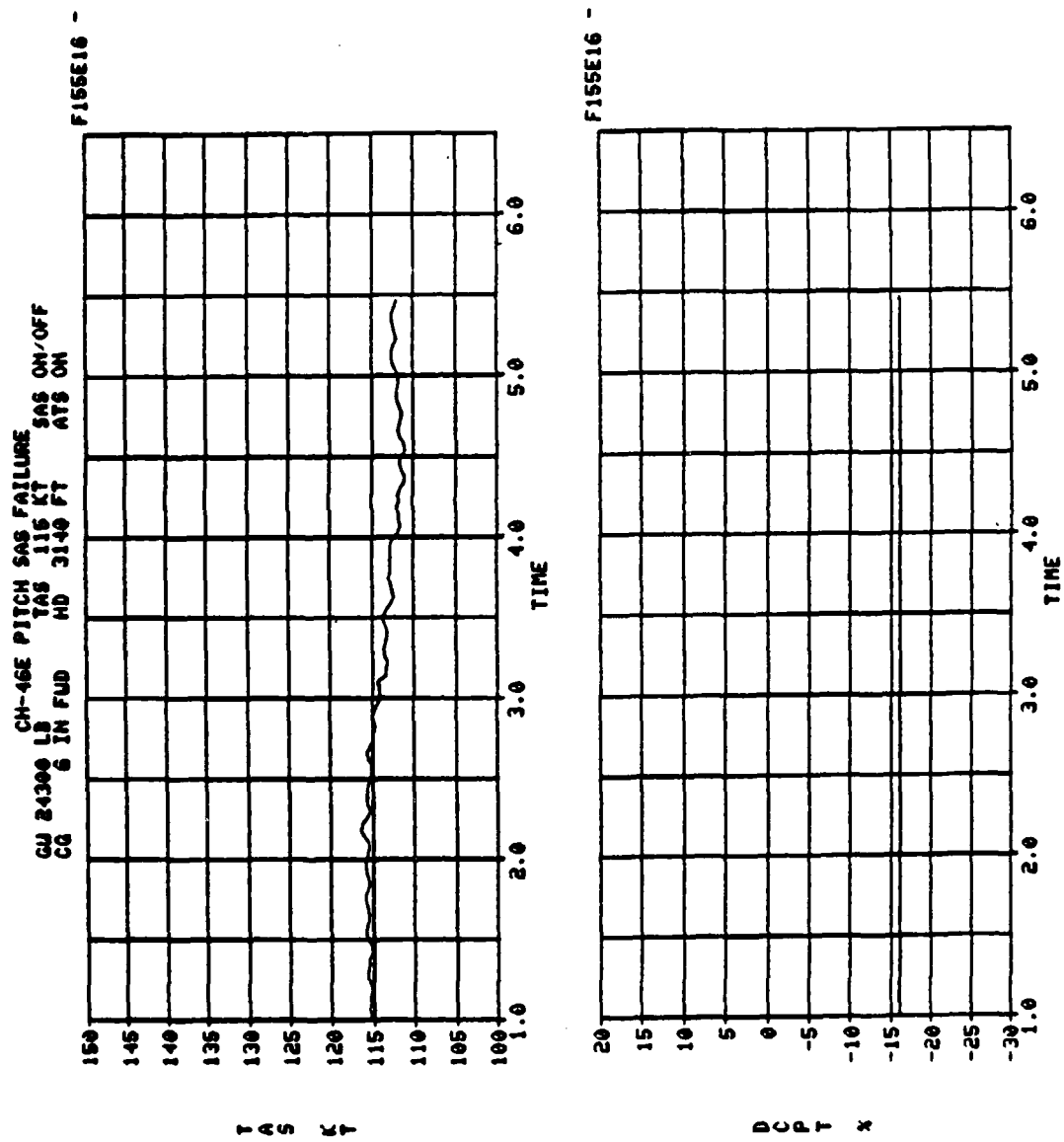


FIGURE 21D

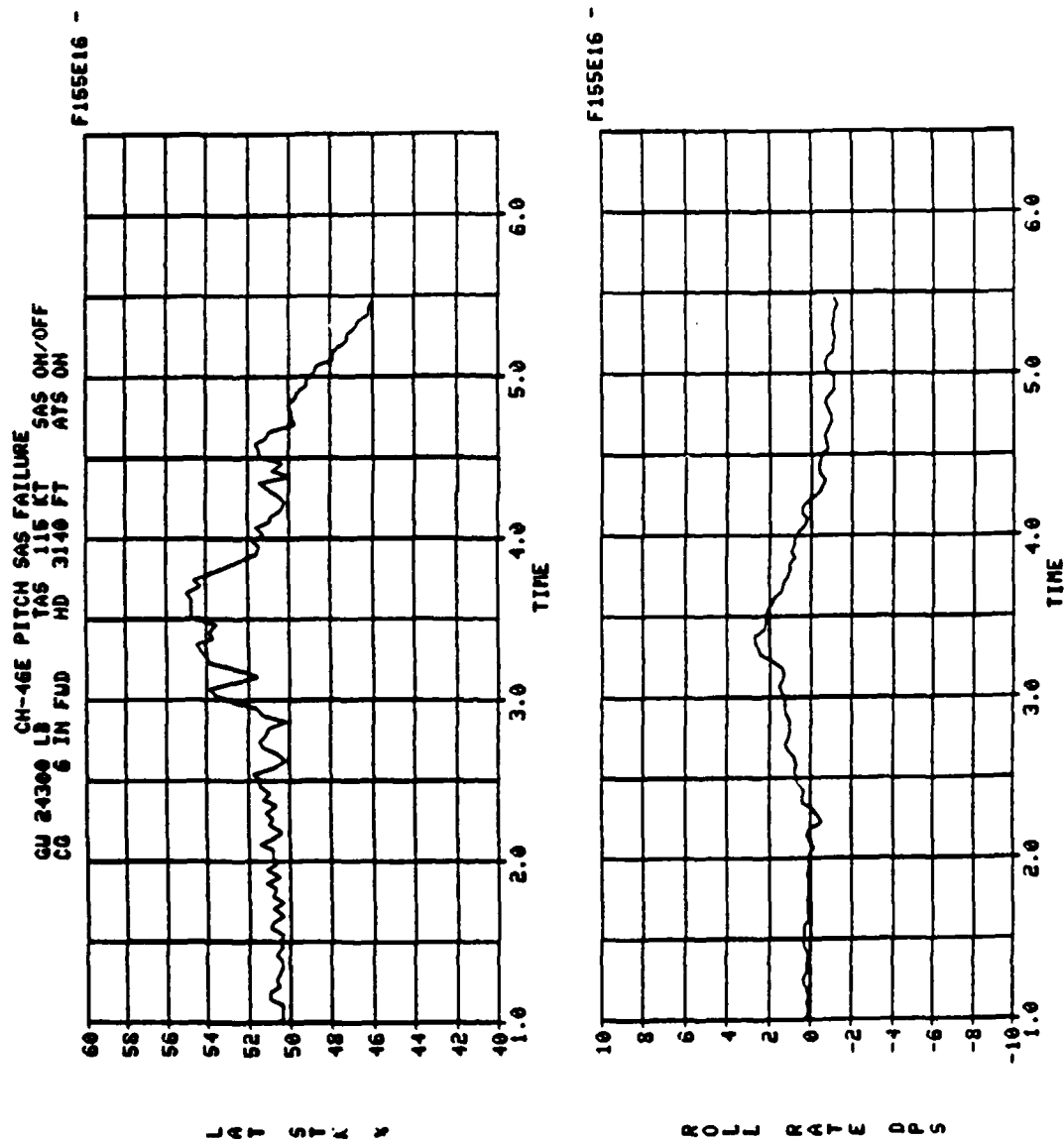


FIGURE 21E

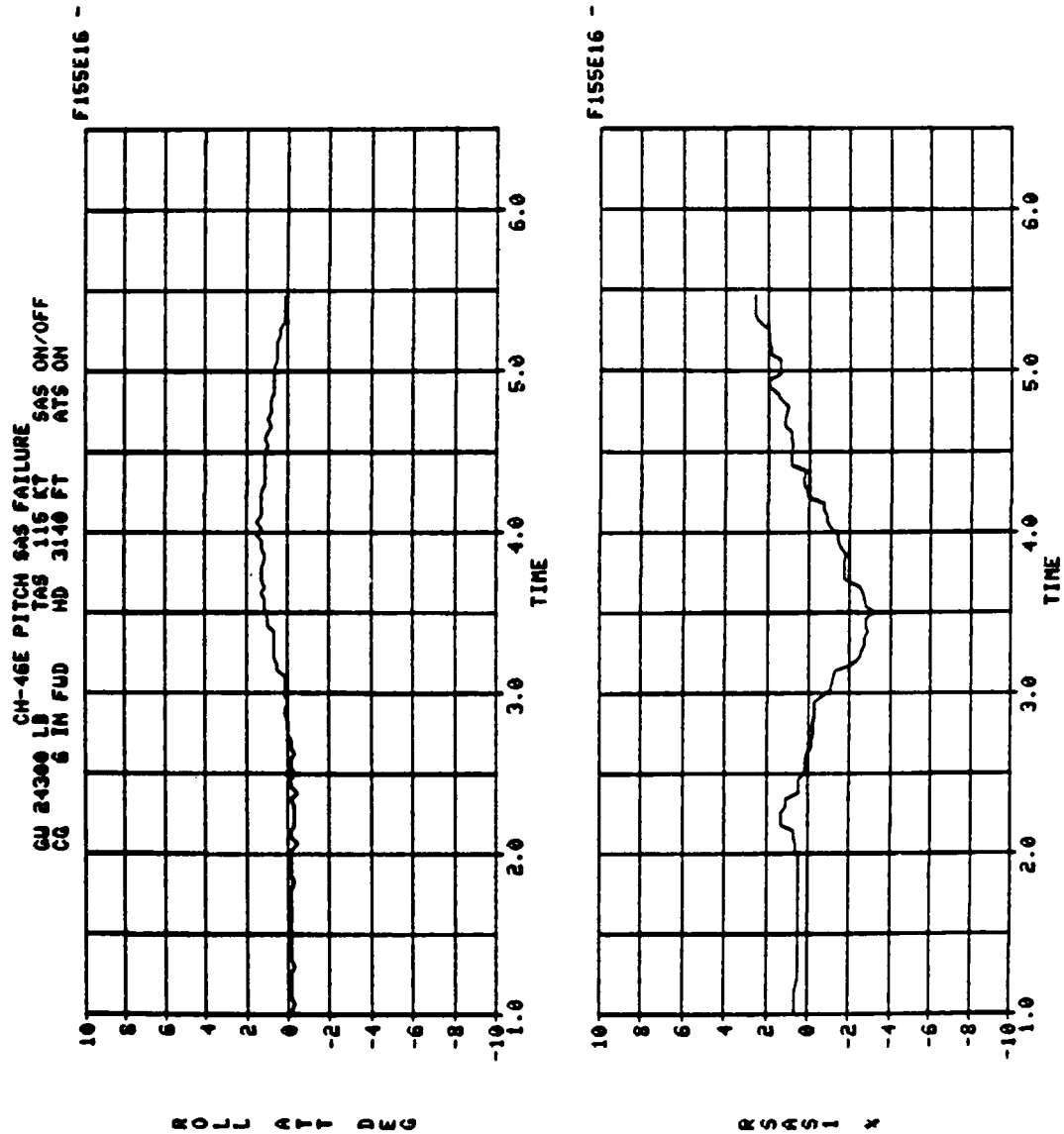


FIGURE 21F

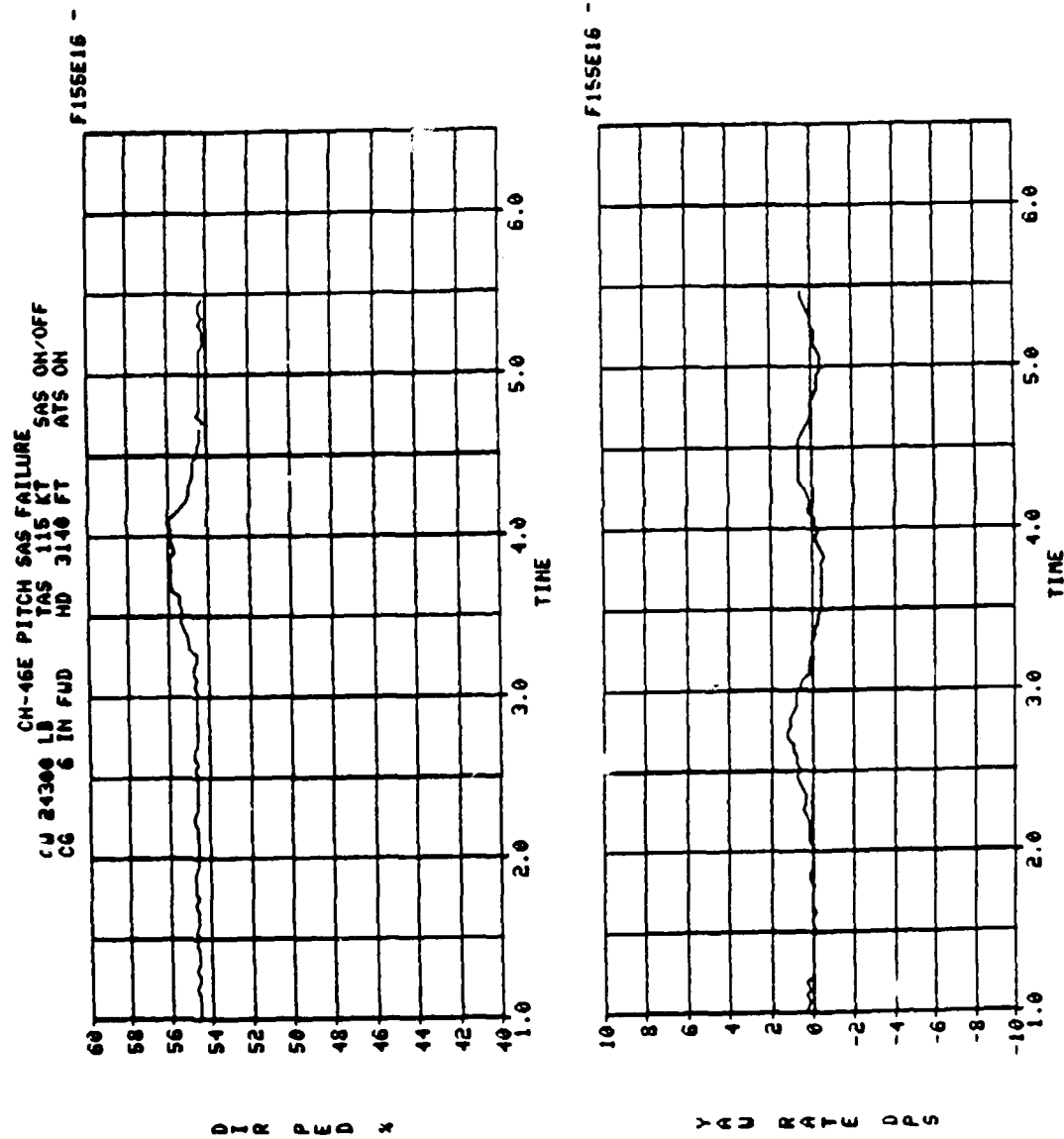


FIGURE 21G



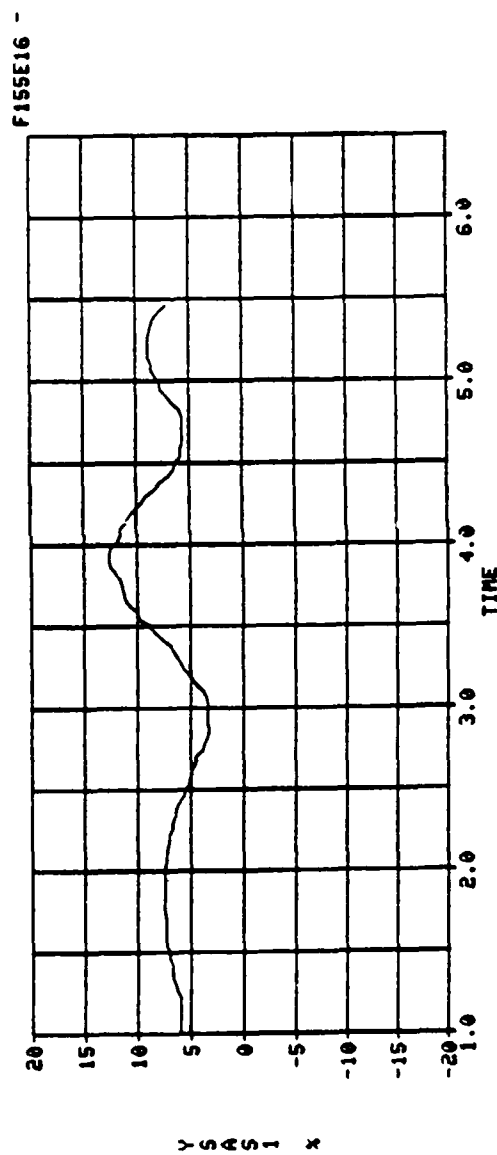
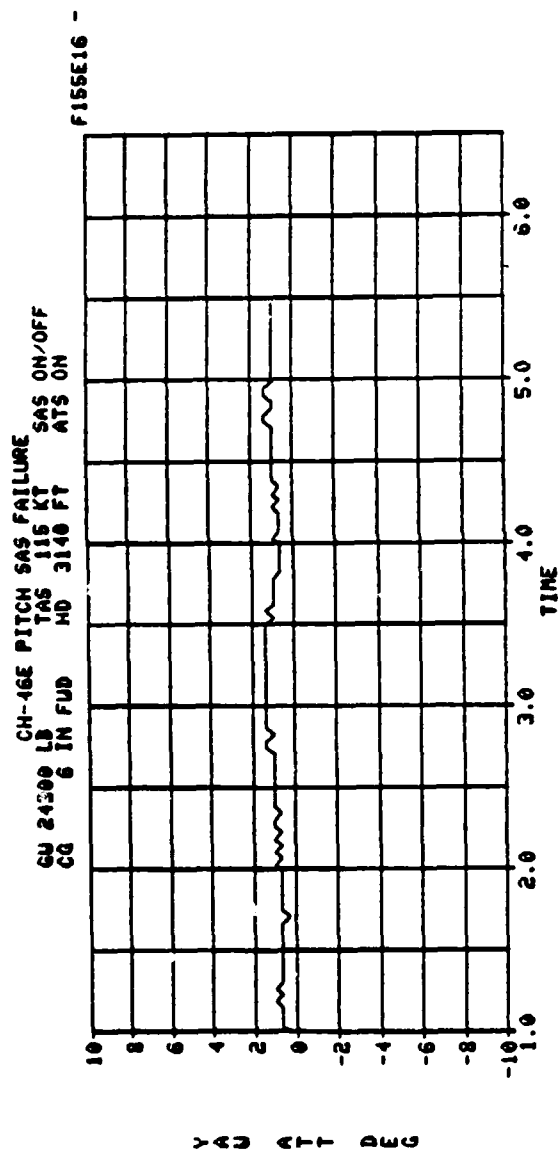


FIGURE 21H

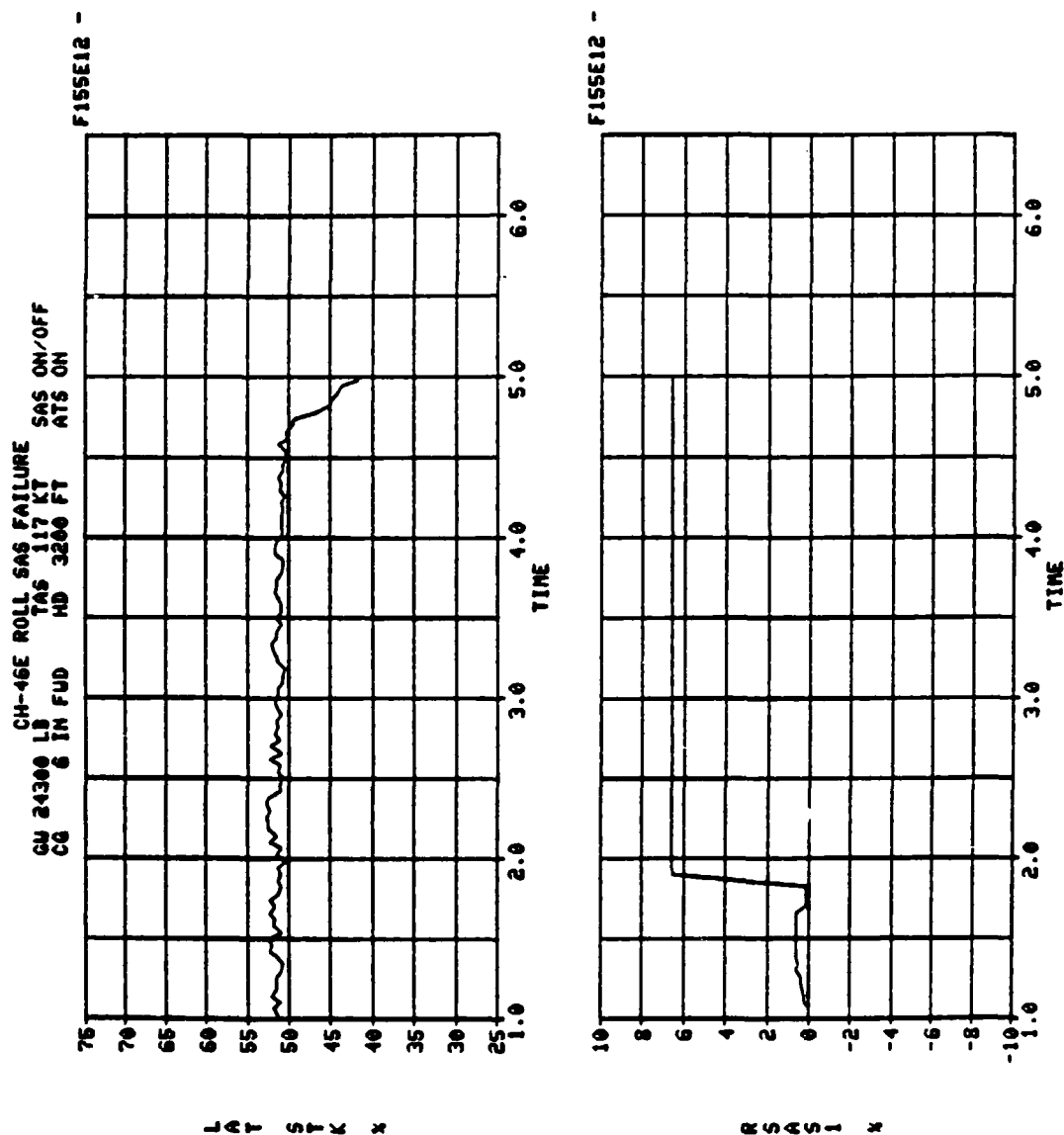


FIGURE 22A

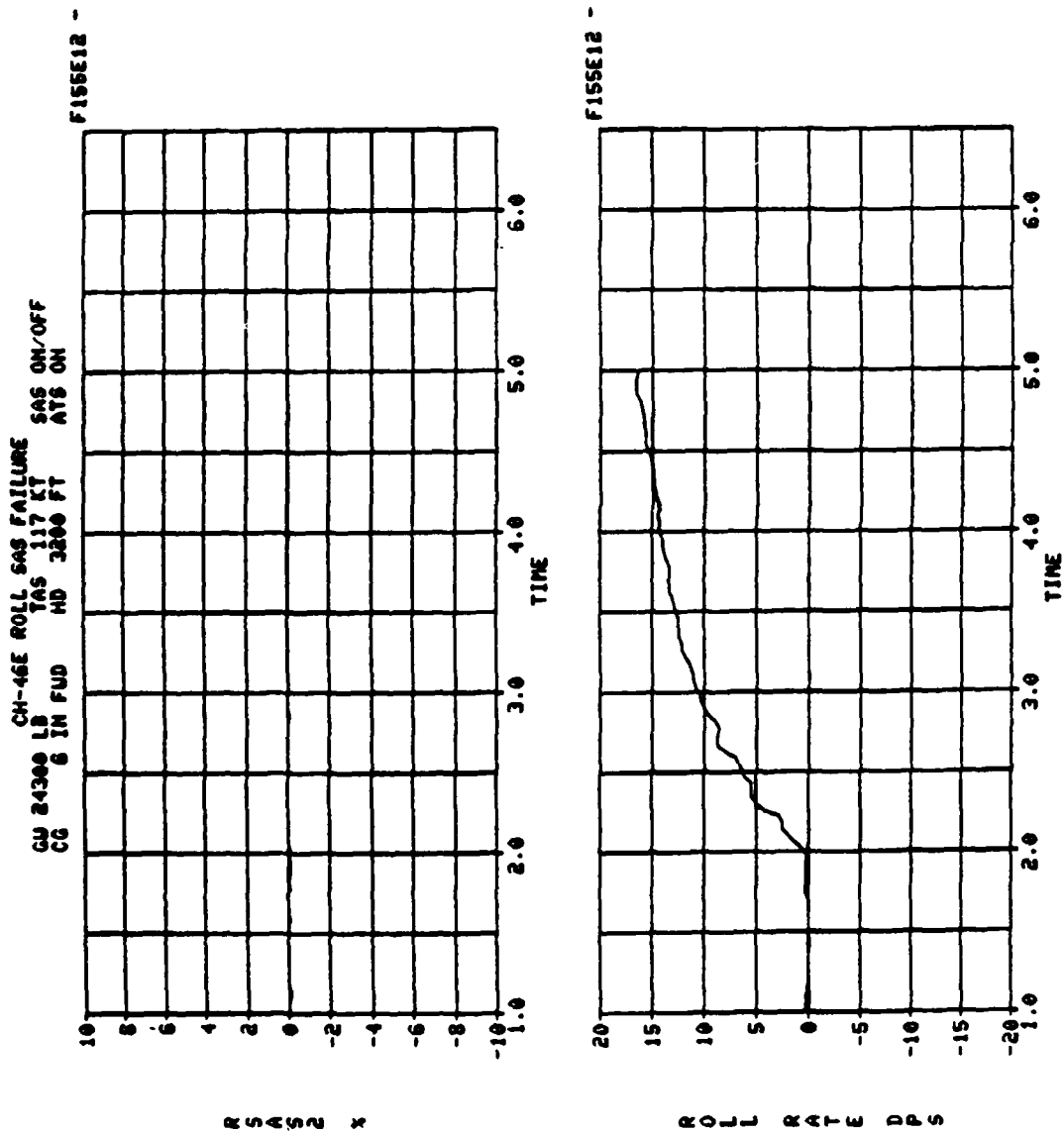


FIGURE 22B

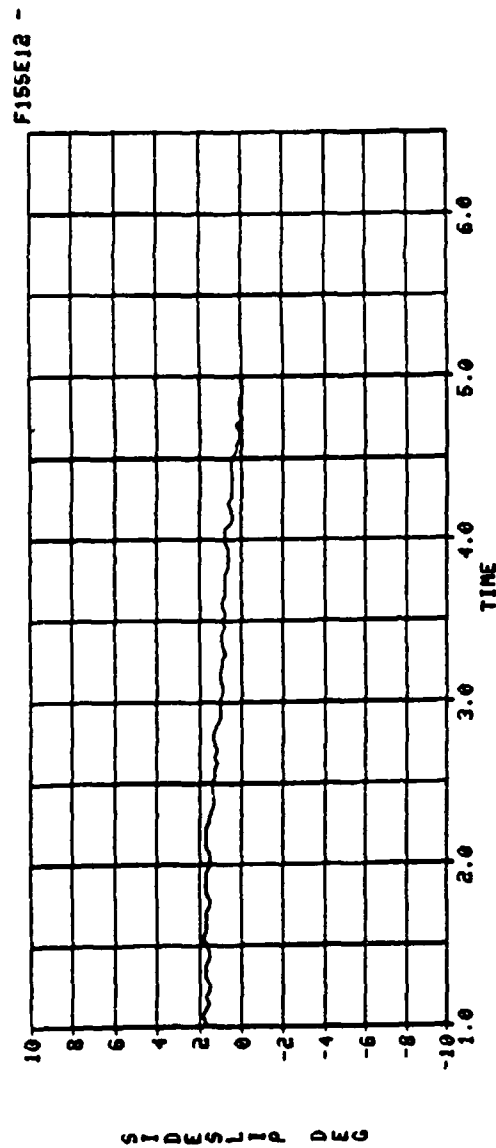
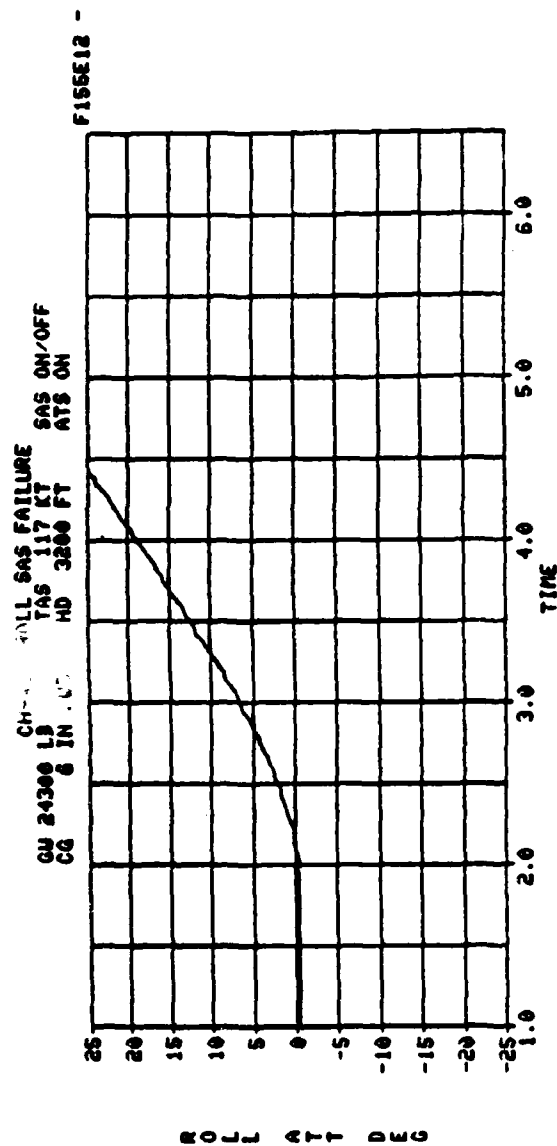


FIGURE 22C

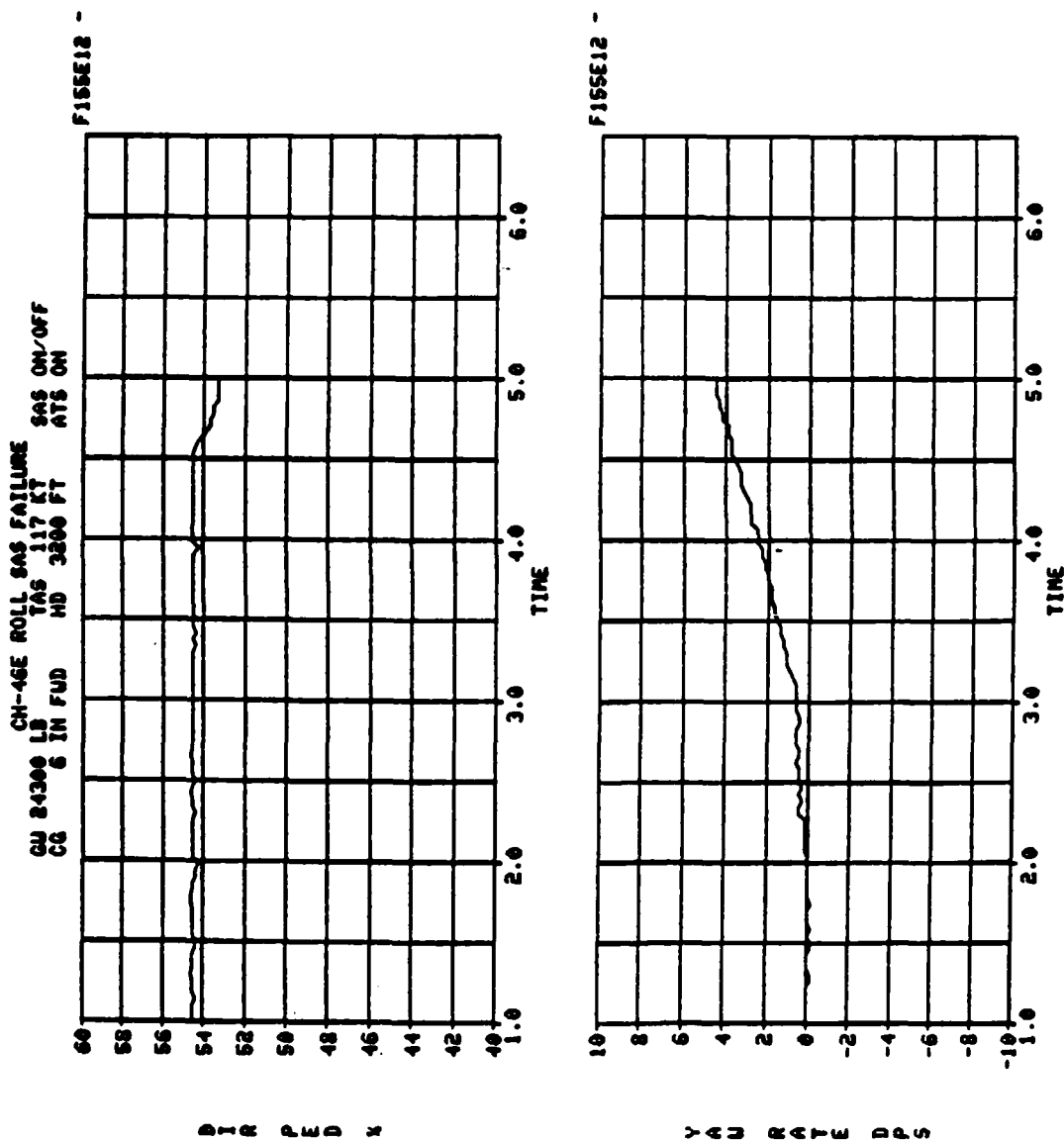


FIGURE 22D

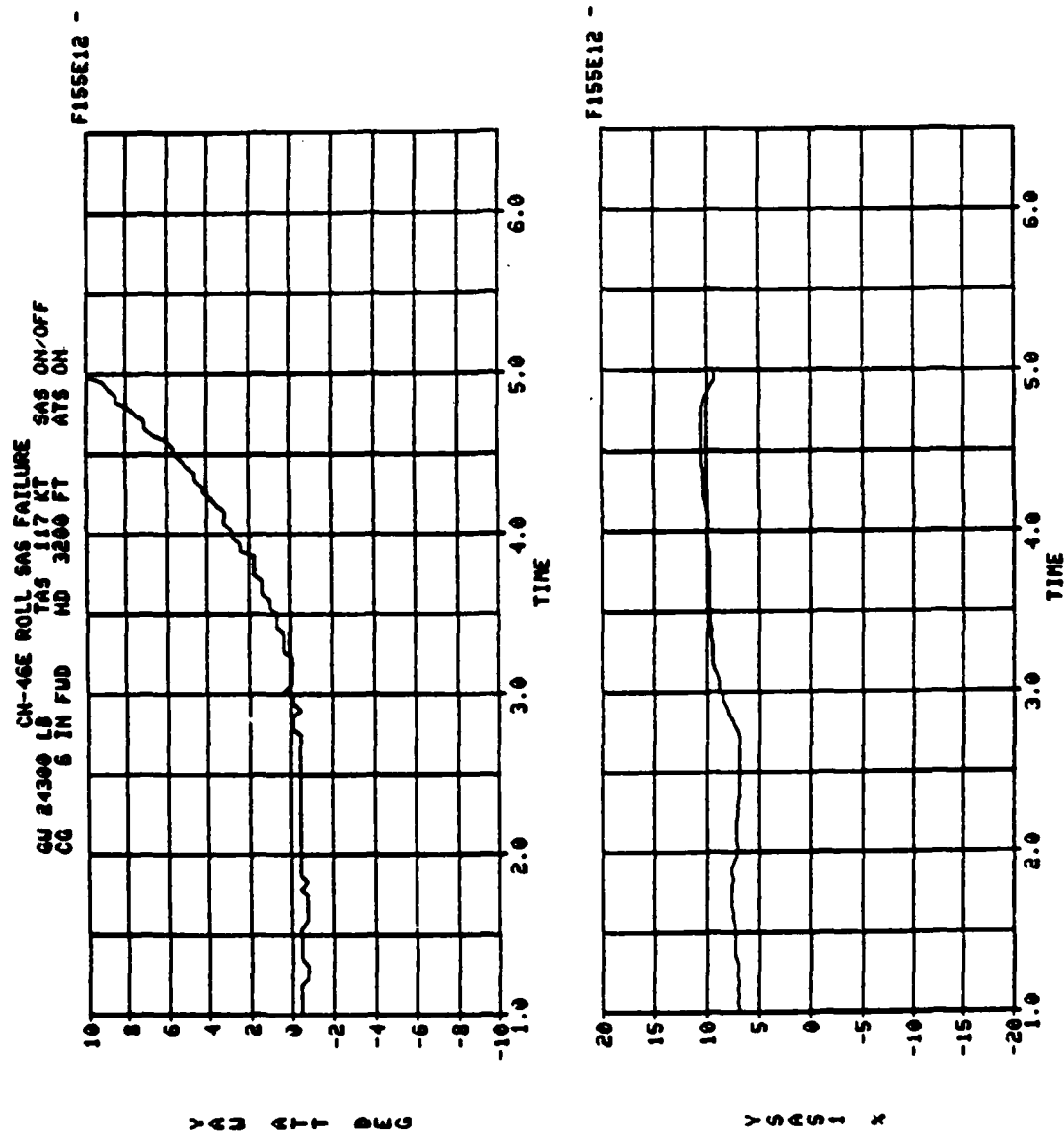


FIGURE 22E

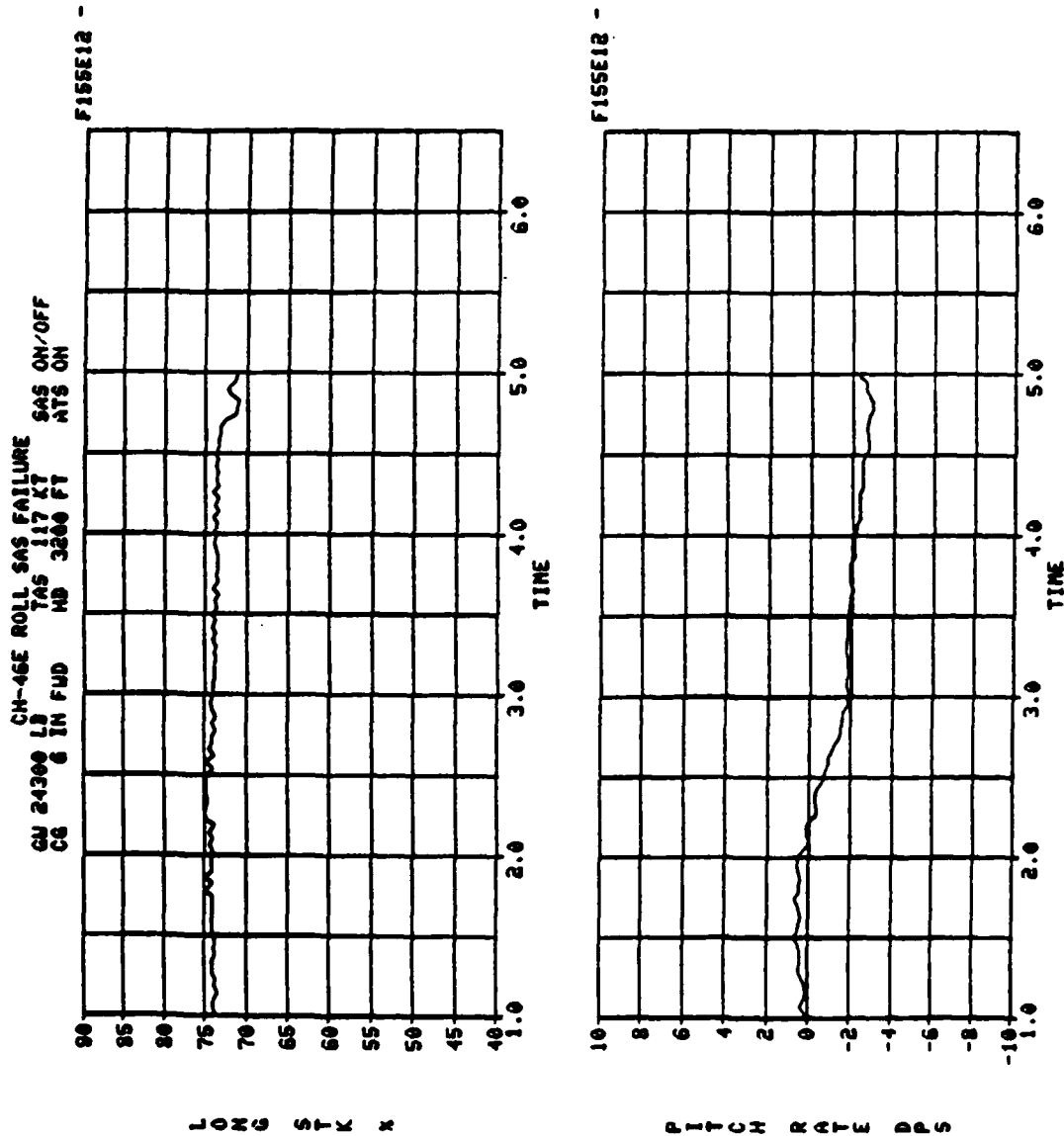


FIGURE 22F

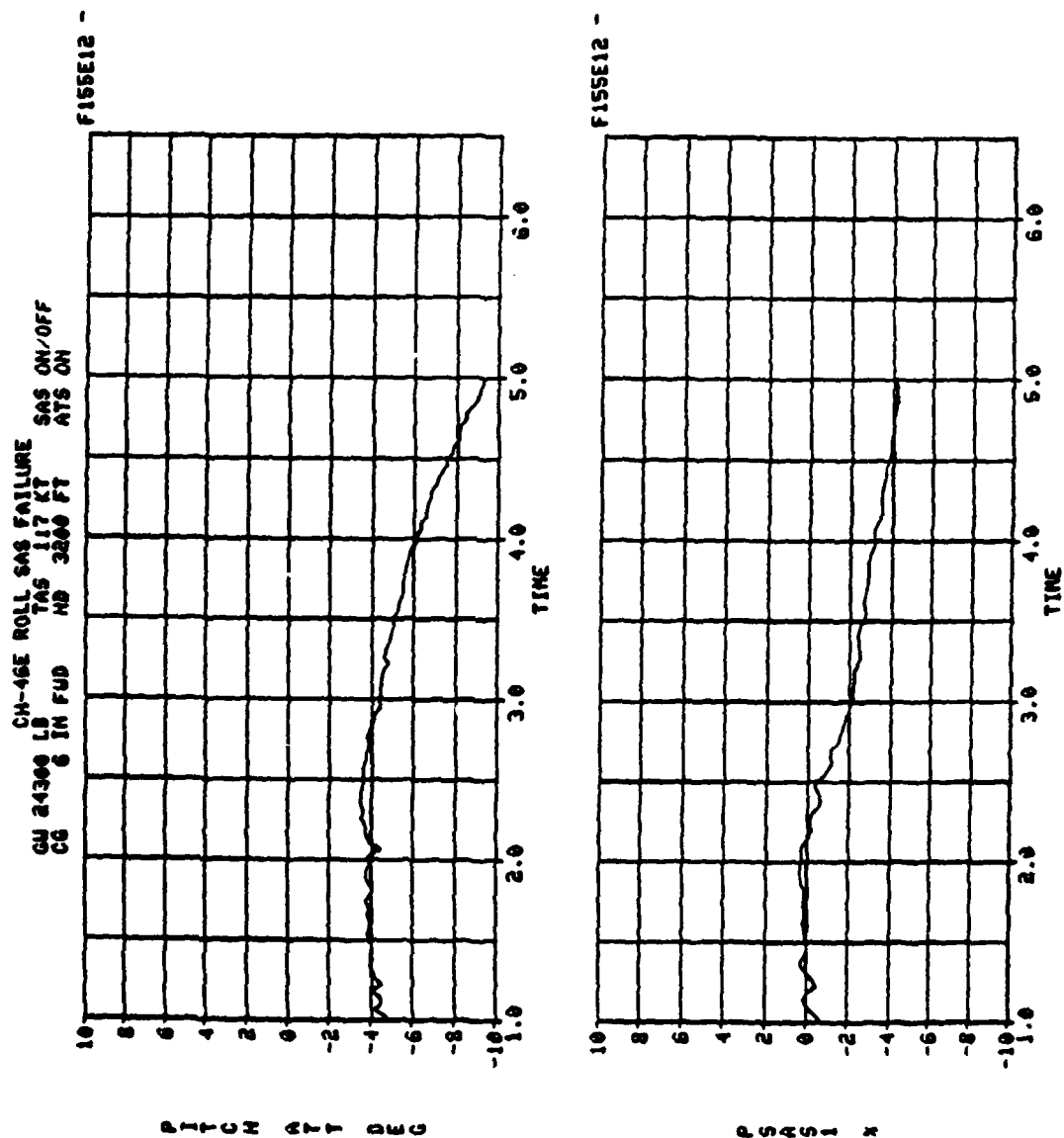


FIGURE 22G



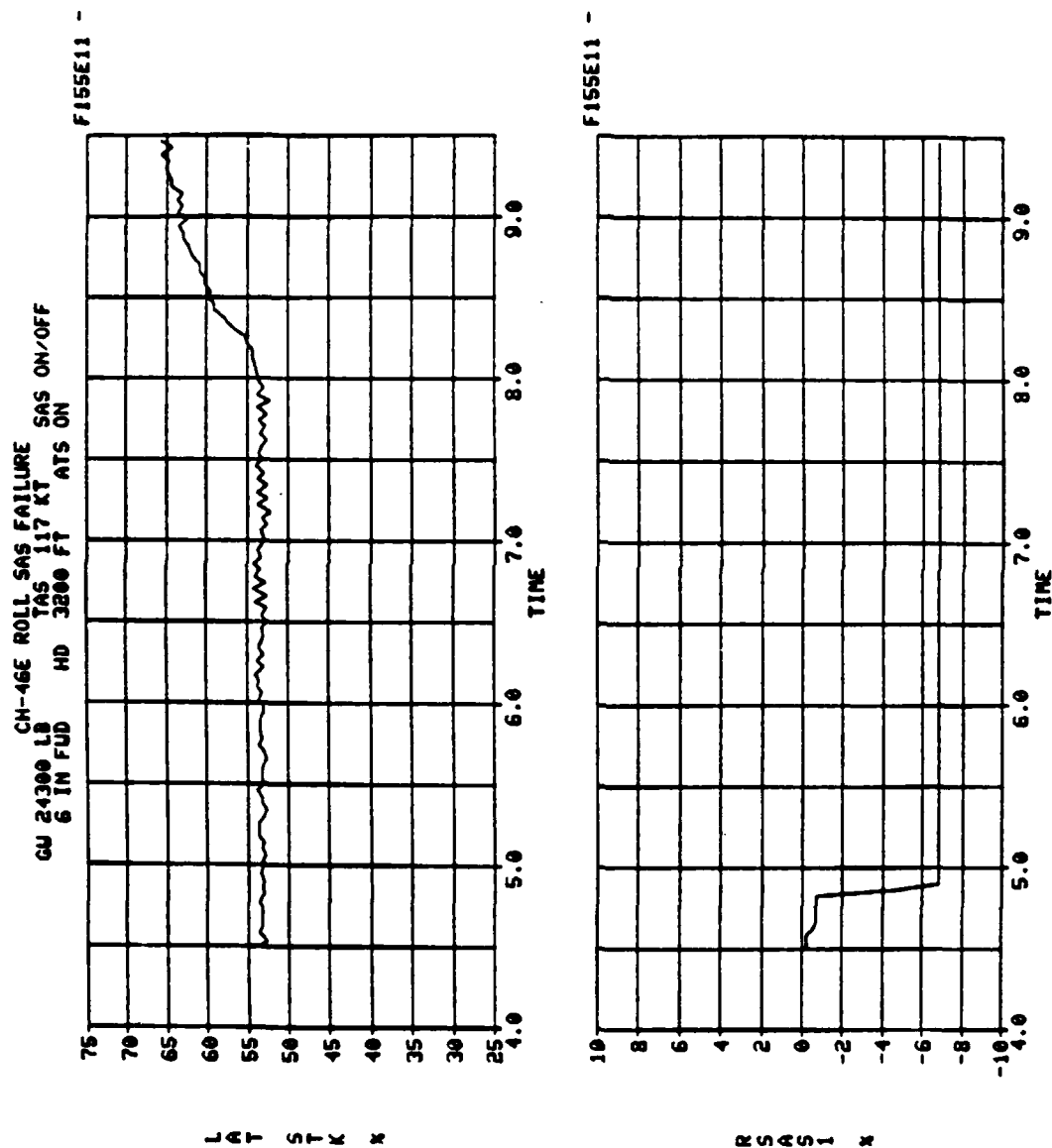


FIGURE 23A

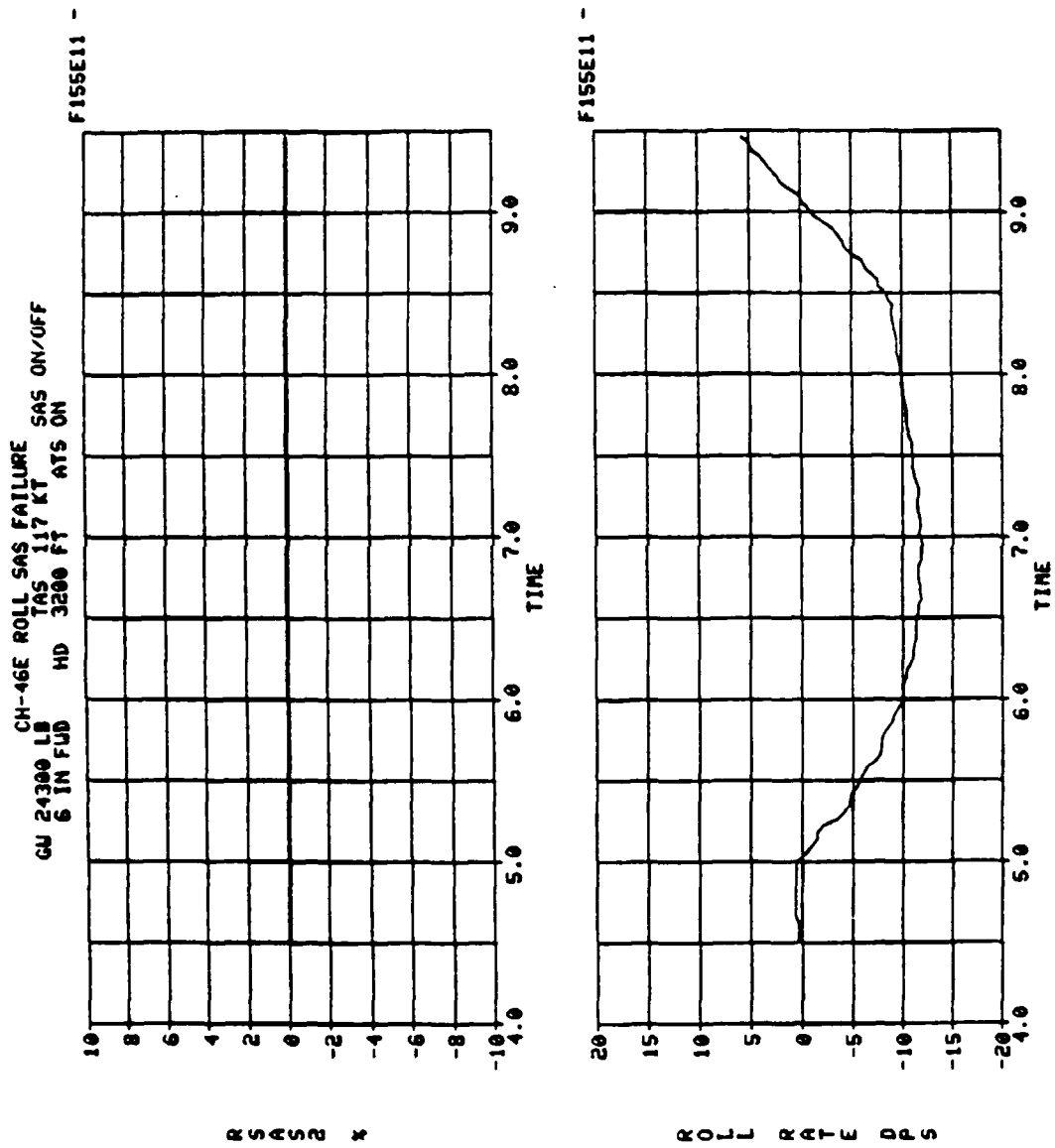


FIGURE 23B

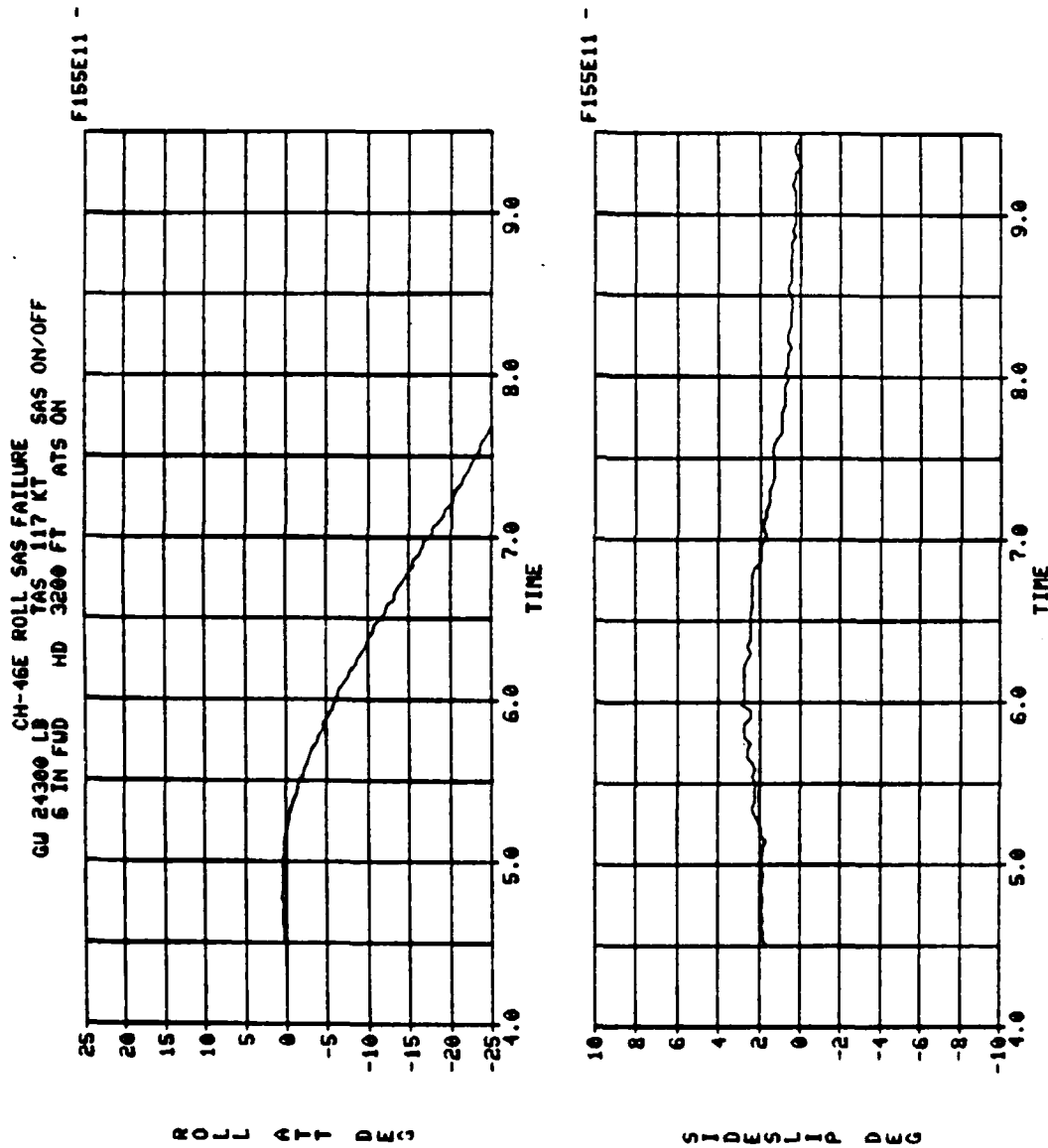


FIGURE 23C

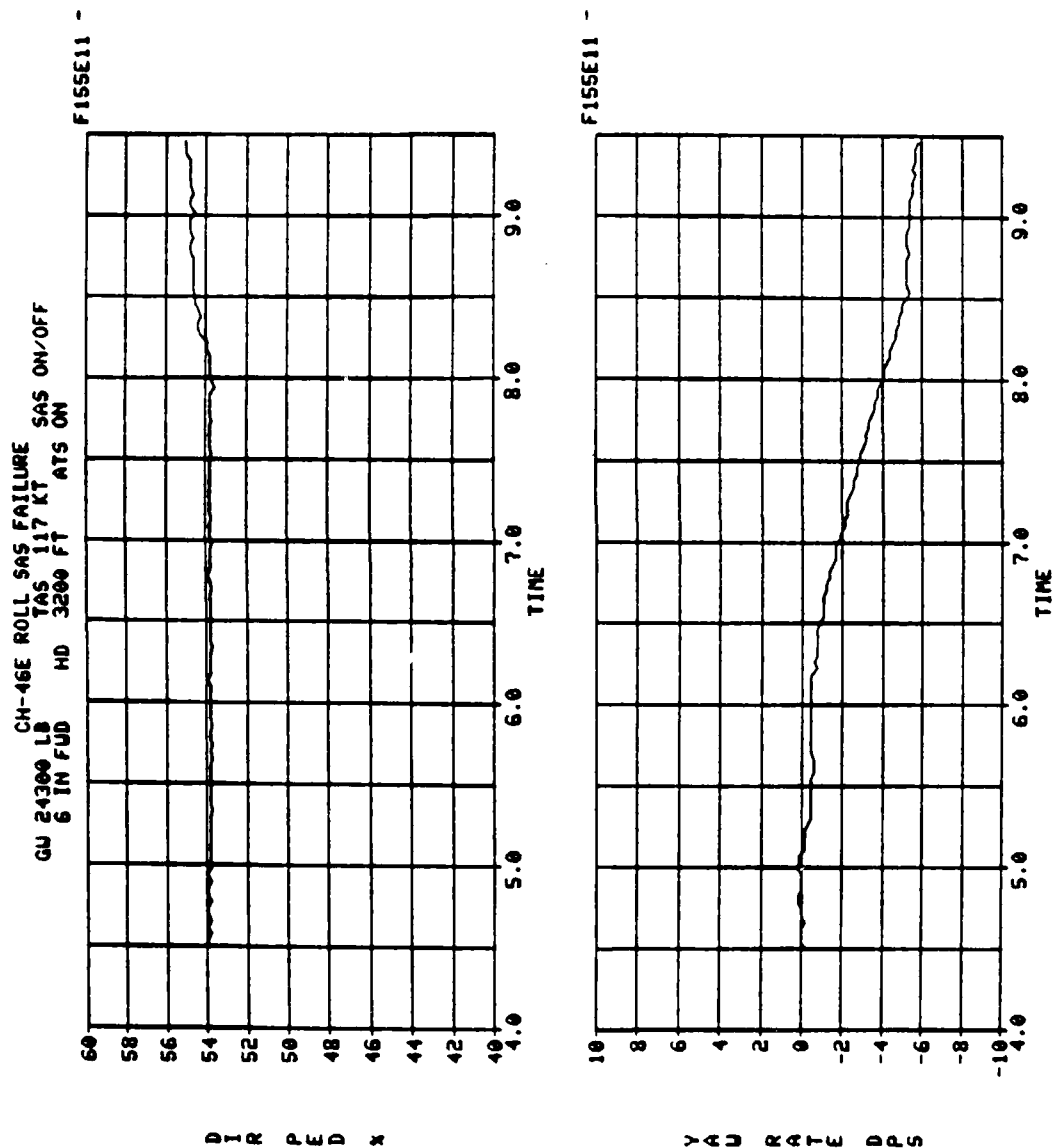


FIGURE 230

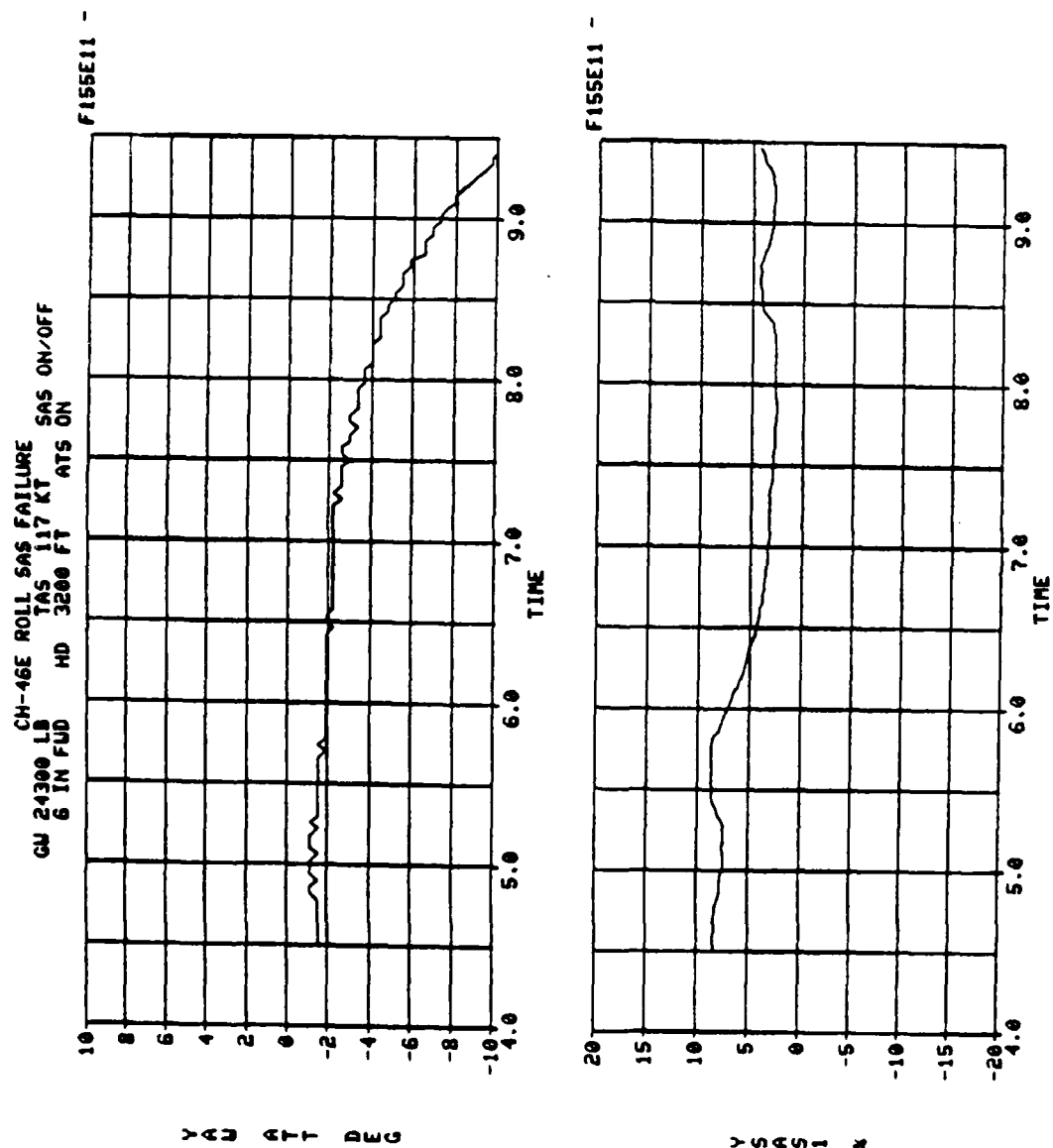


FIGURE 23E

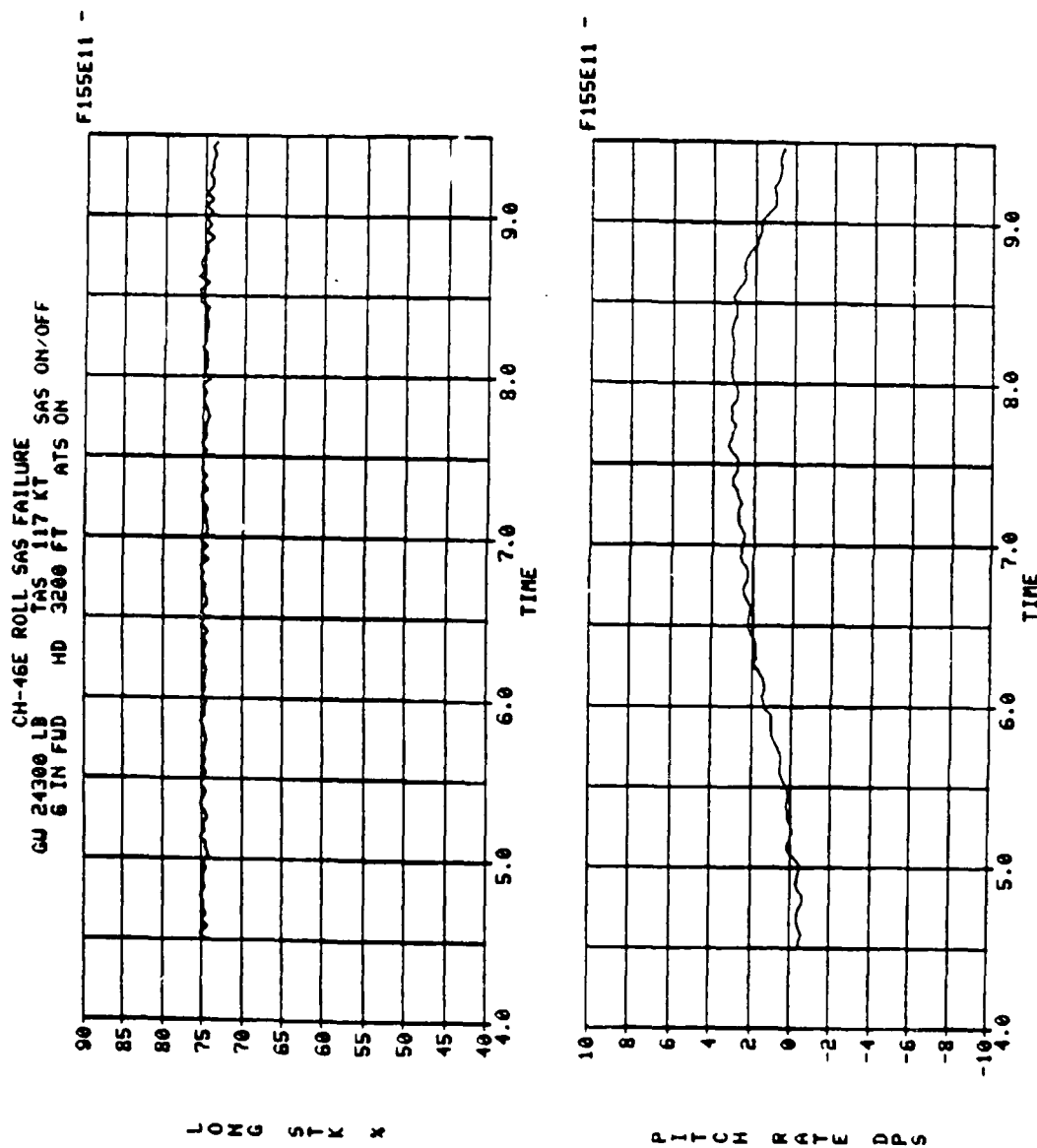


FIGURE 23F

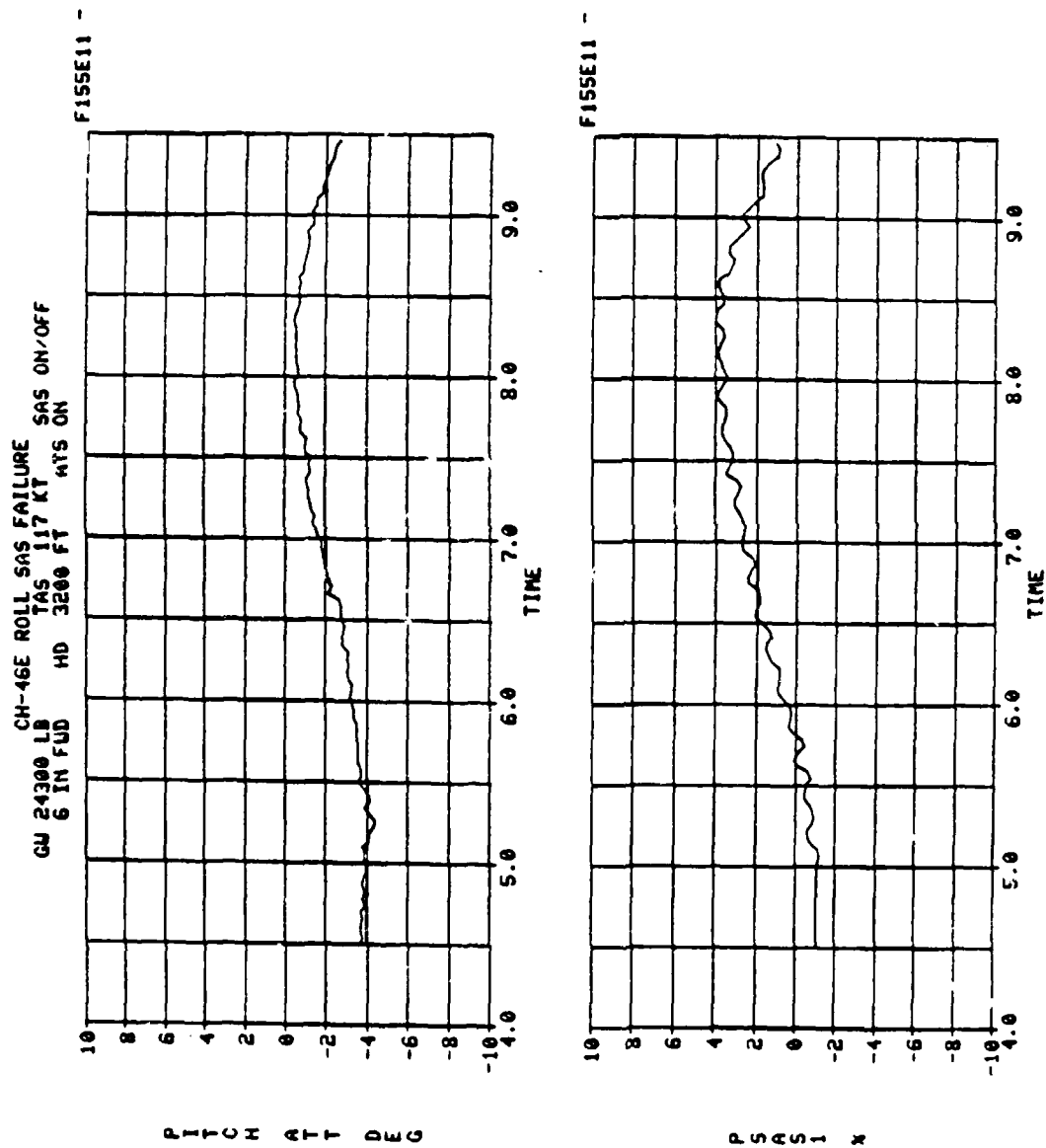


FIGURE 23G

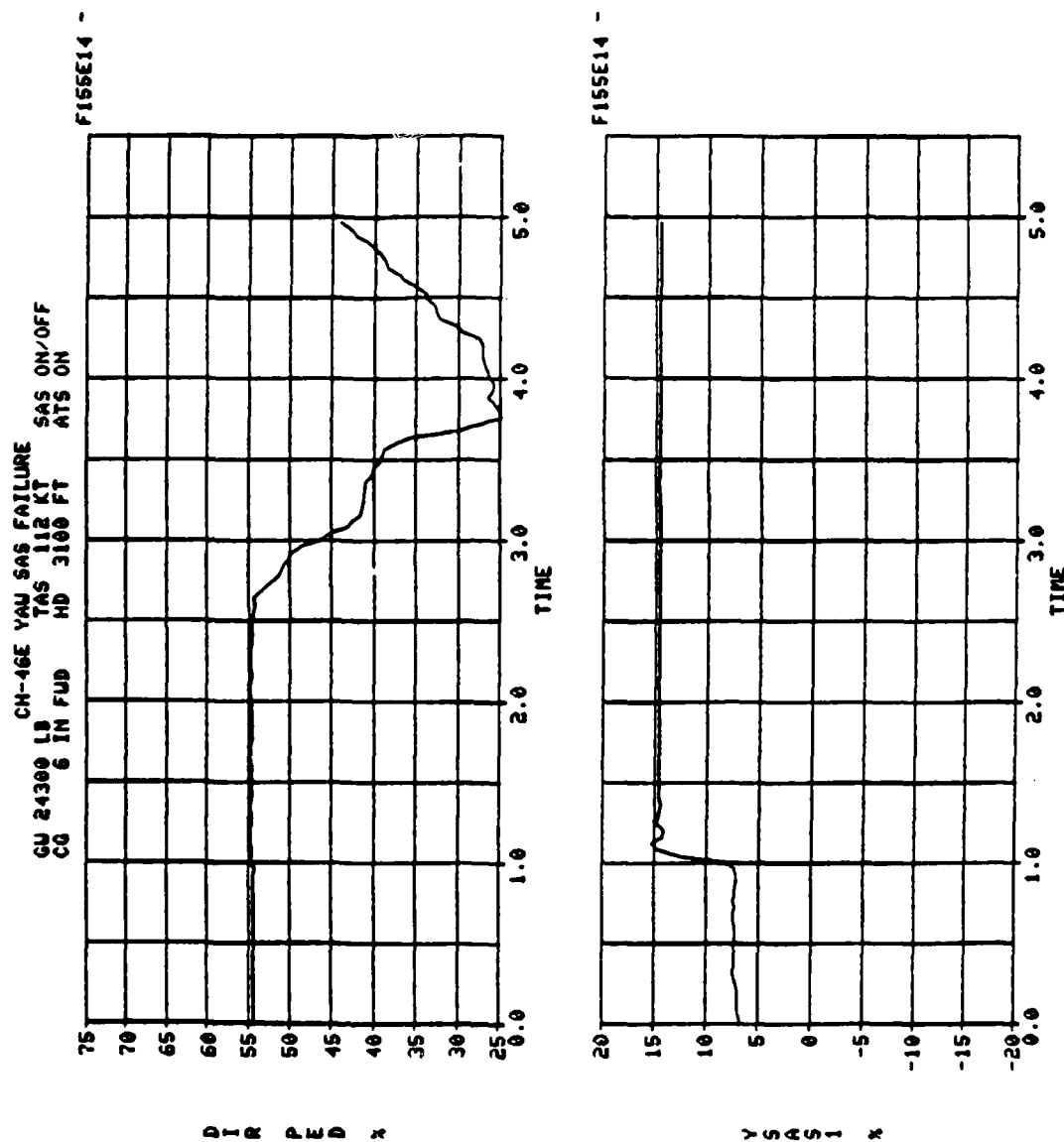


FIGURE 24A



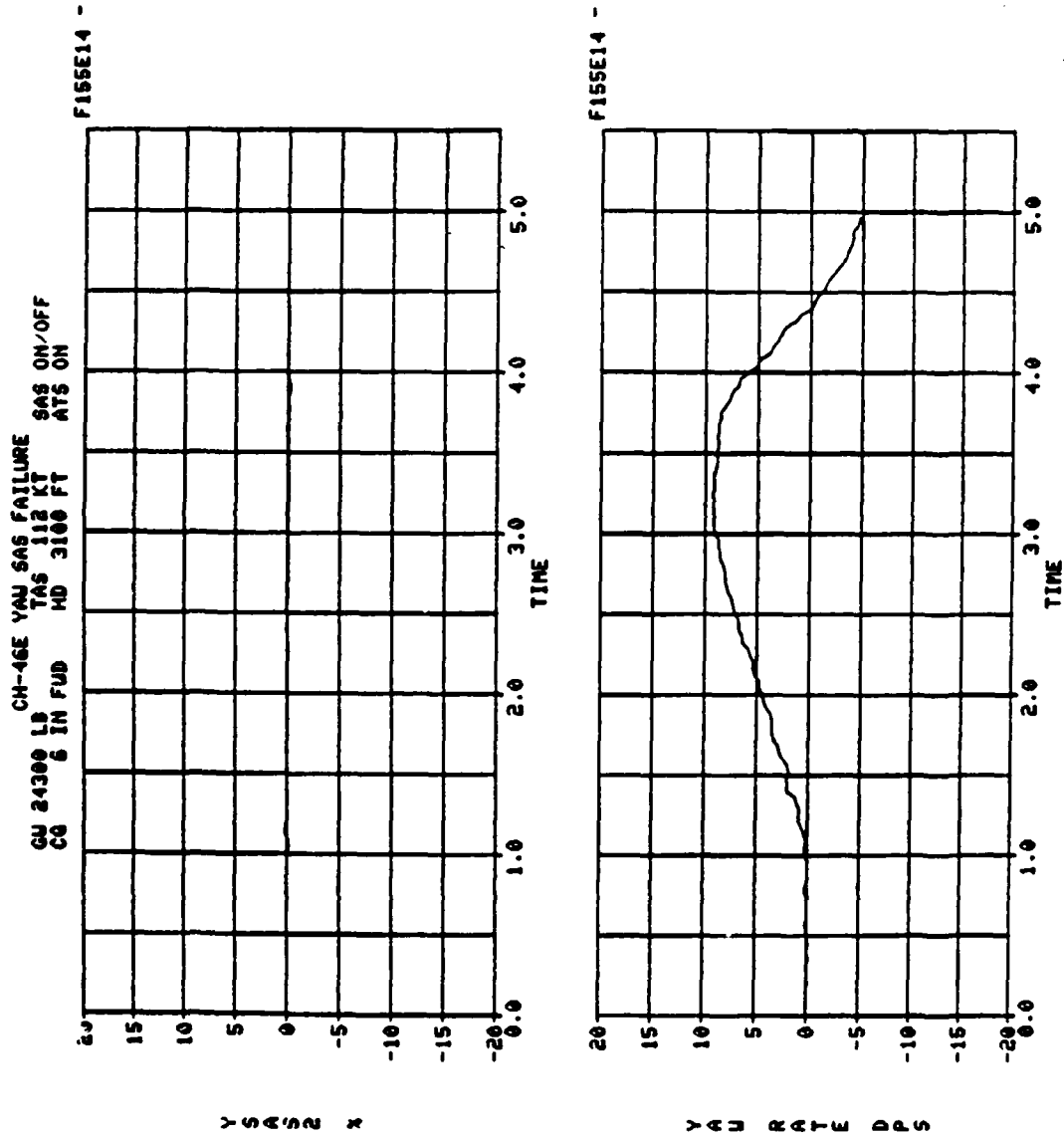


FIGURE 24B

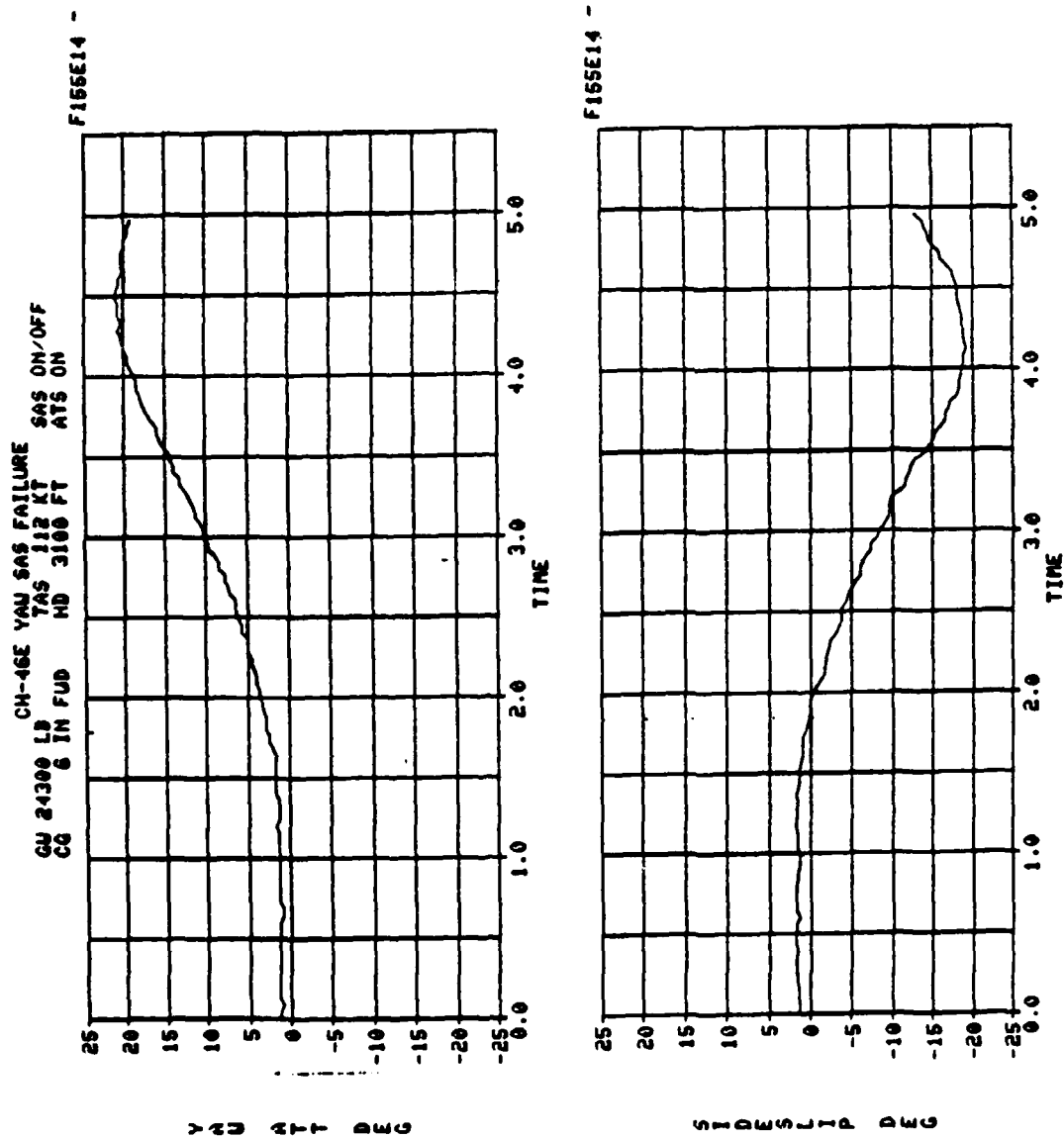


FIGURE 24C

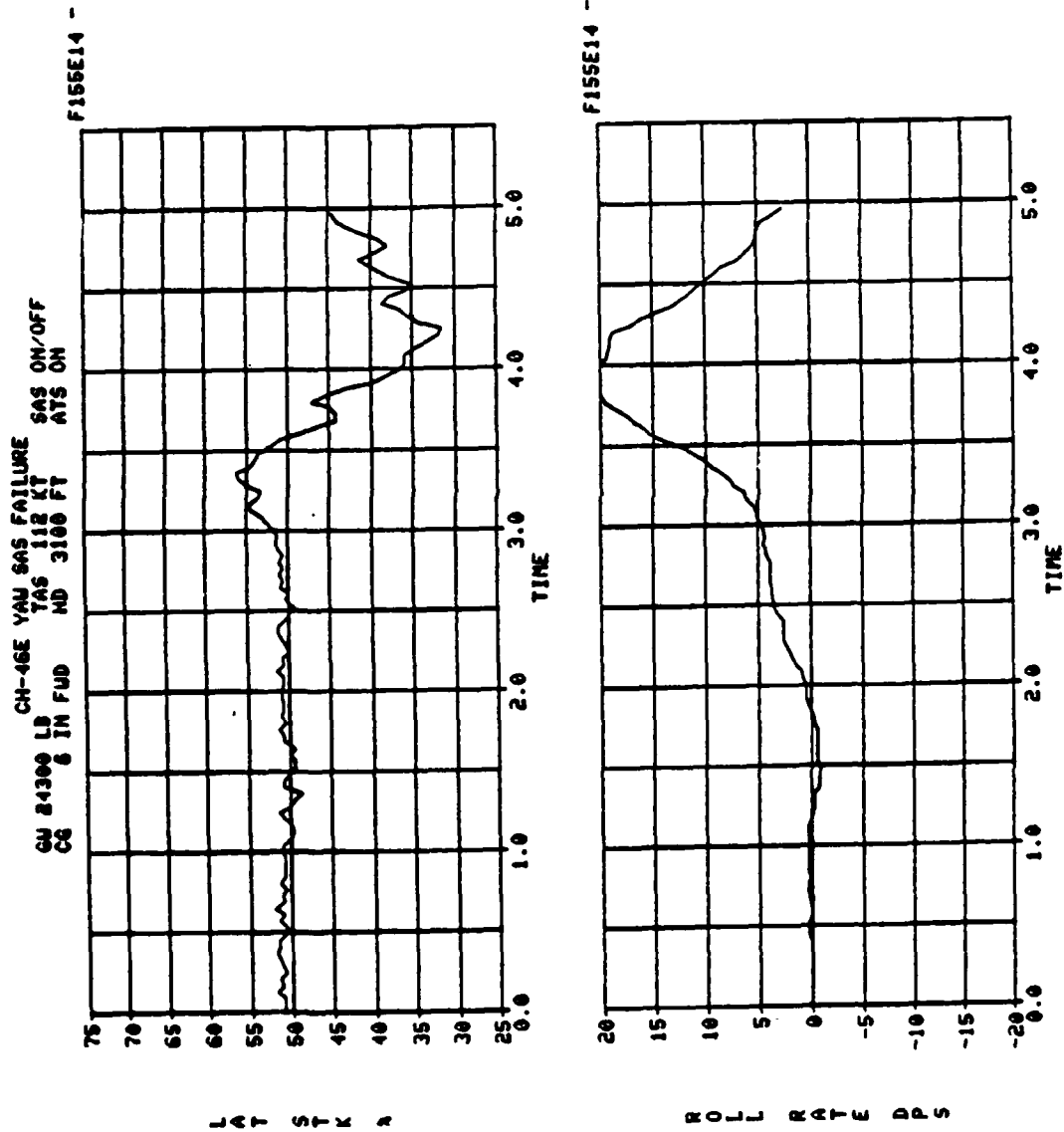


FIGURE 24D

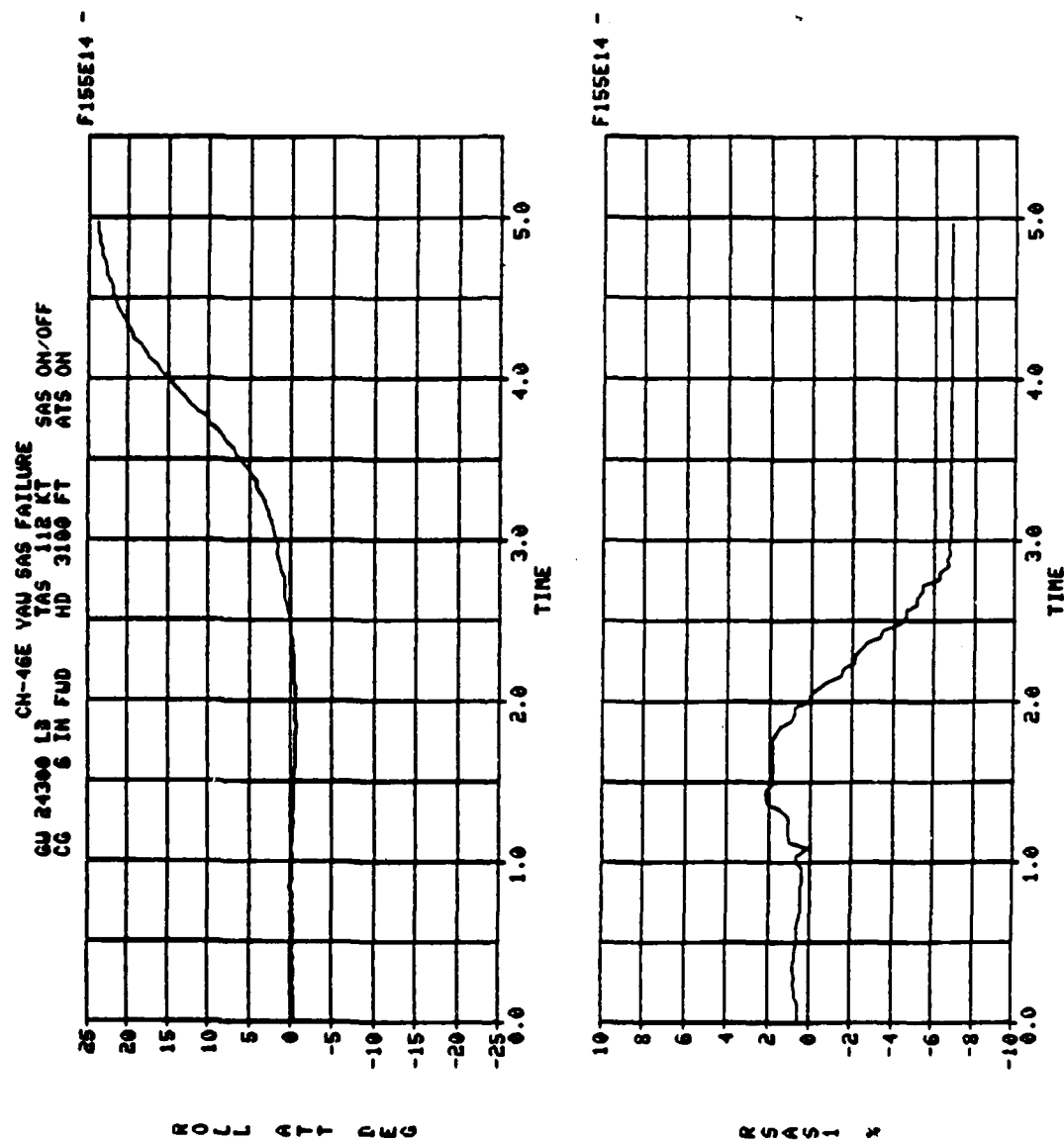


FIGURE 24E

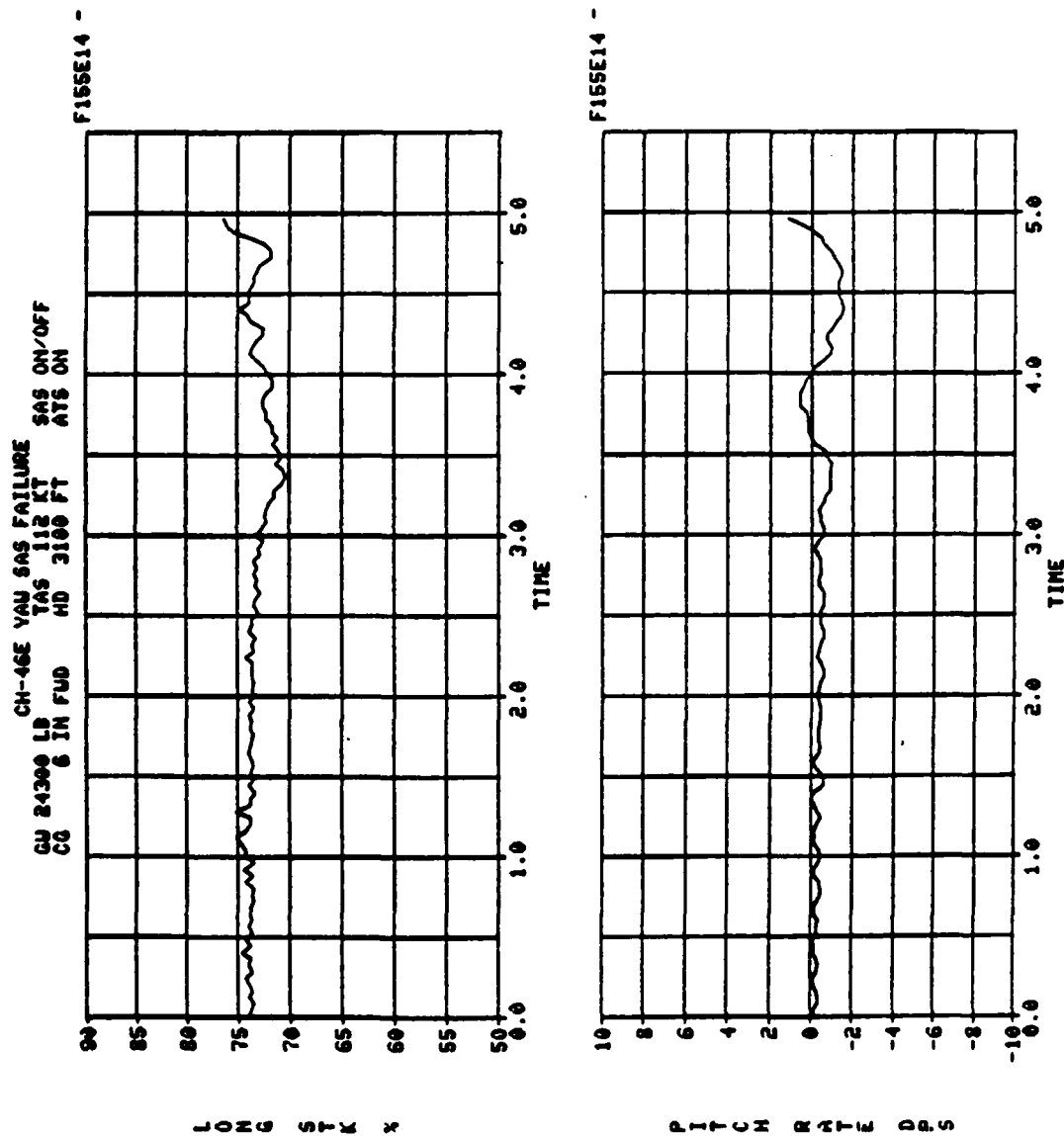


FIGURE 24F

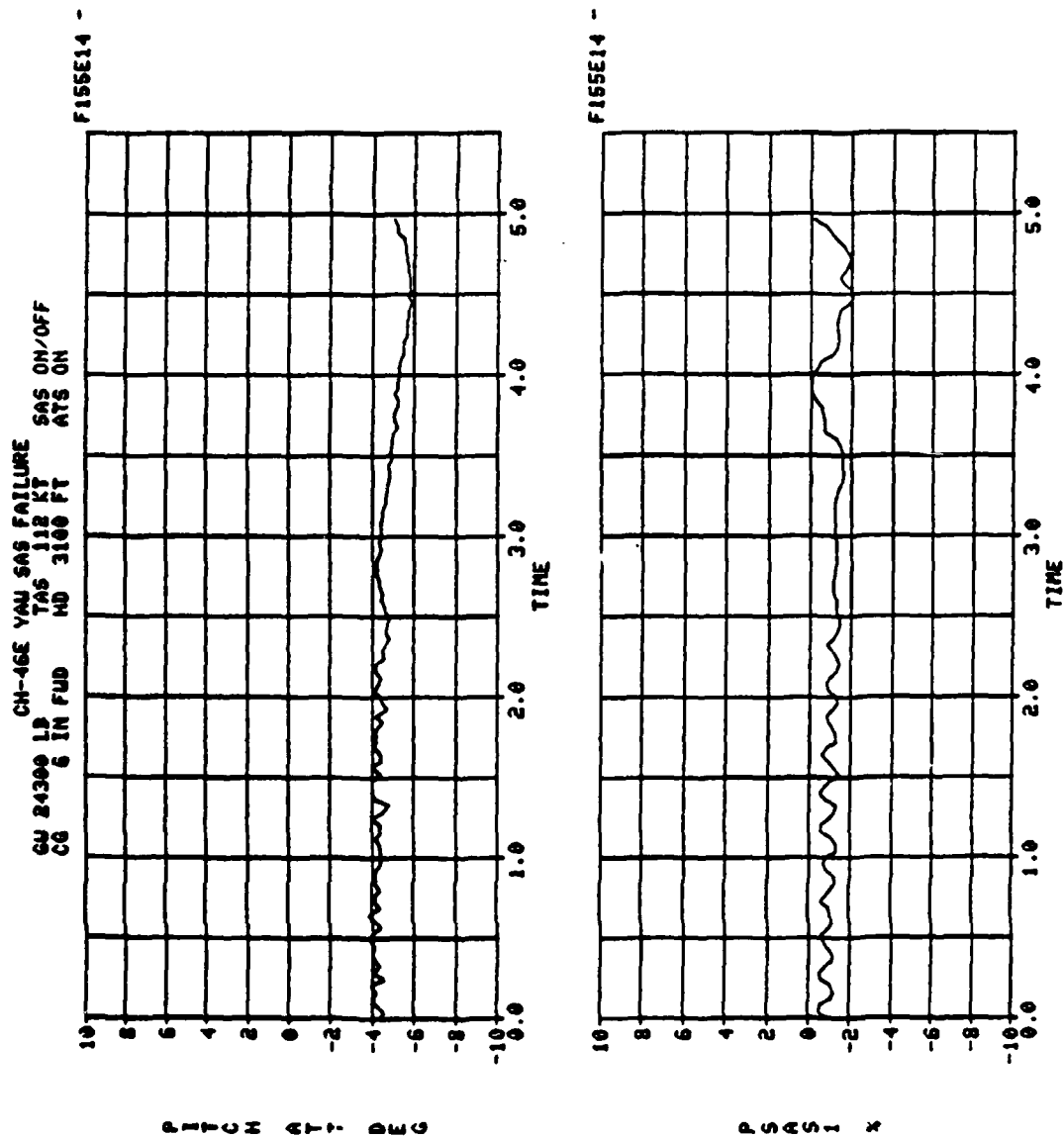


FIGURE 243

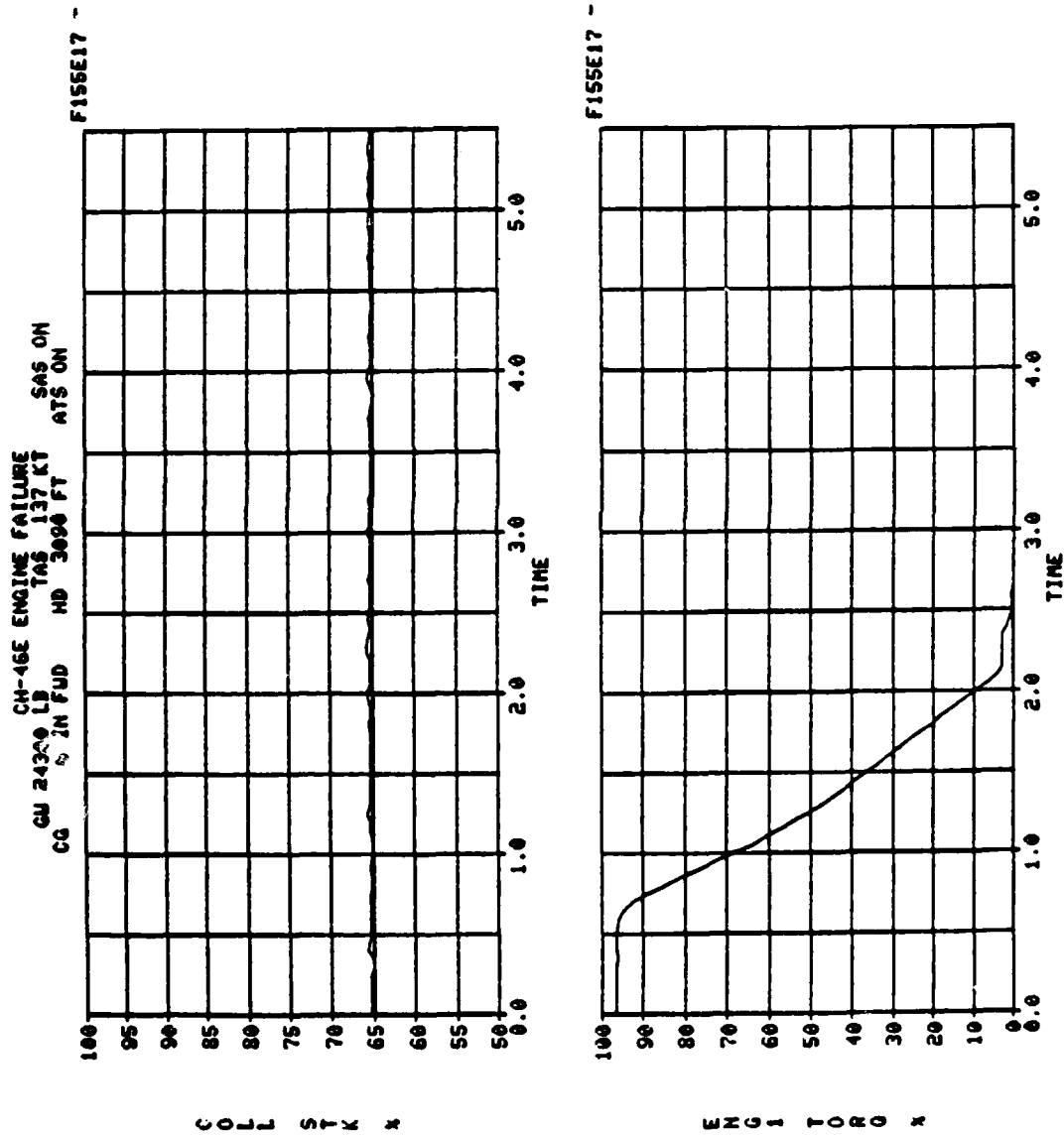


FIGURE 25A

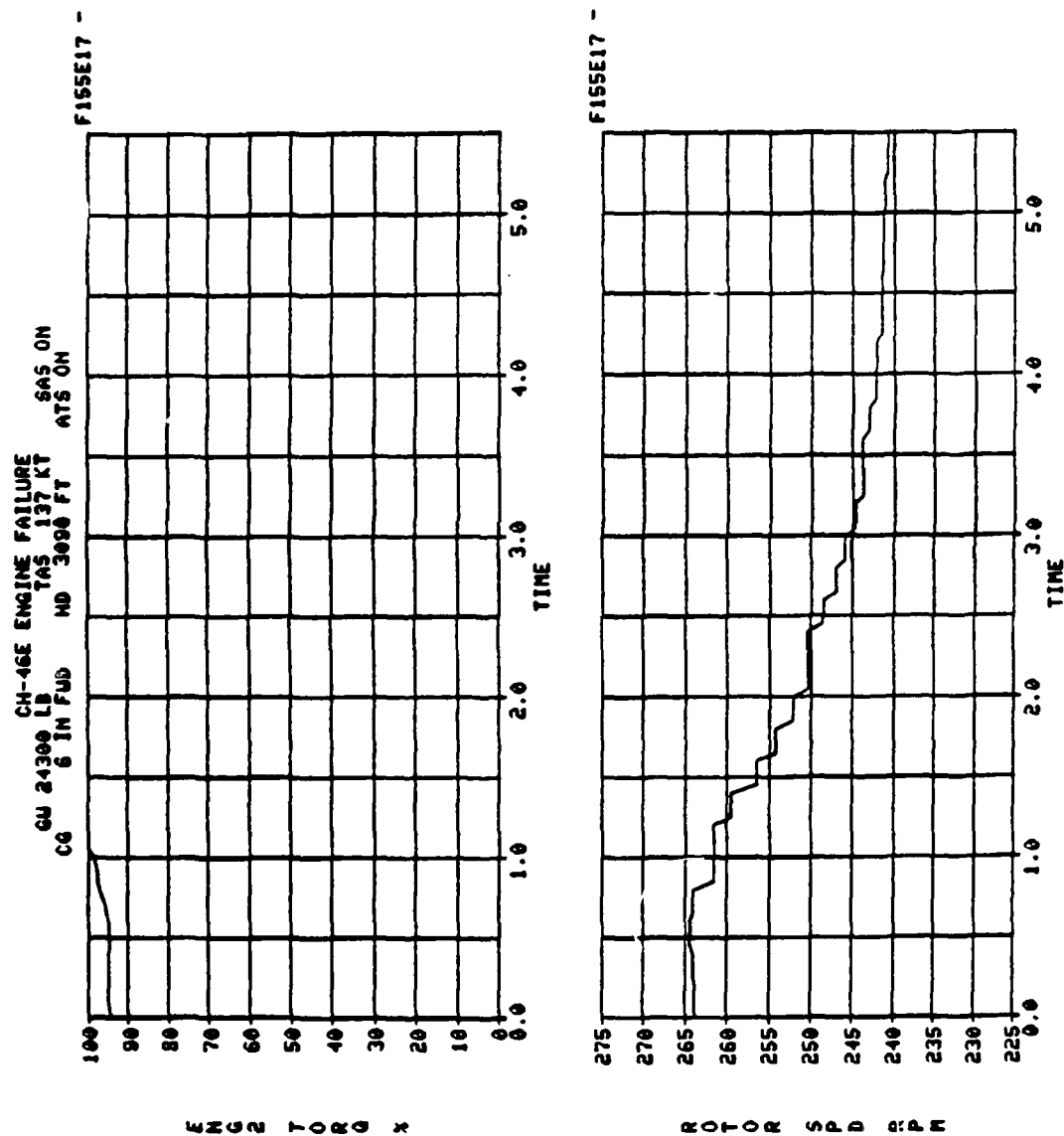


FIGURE 25B



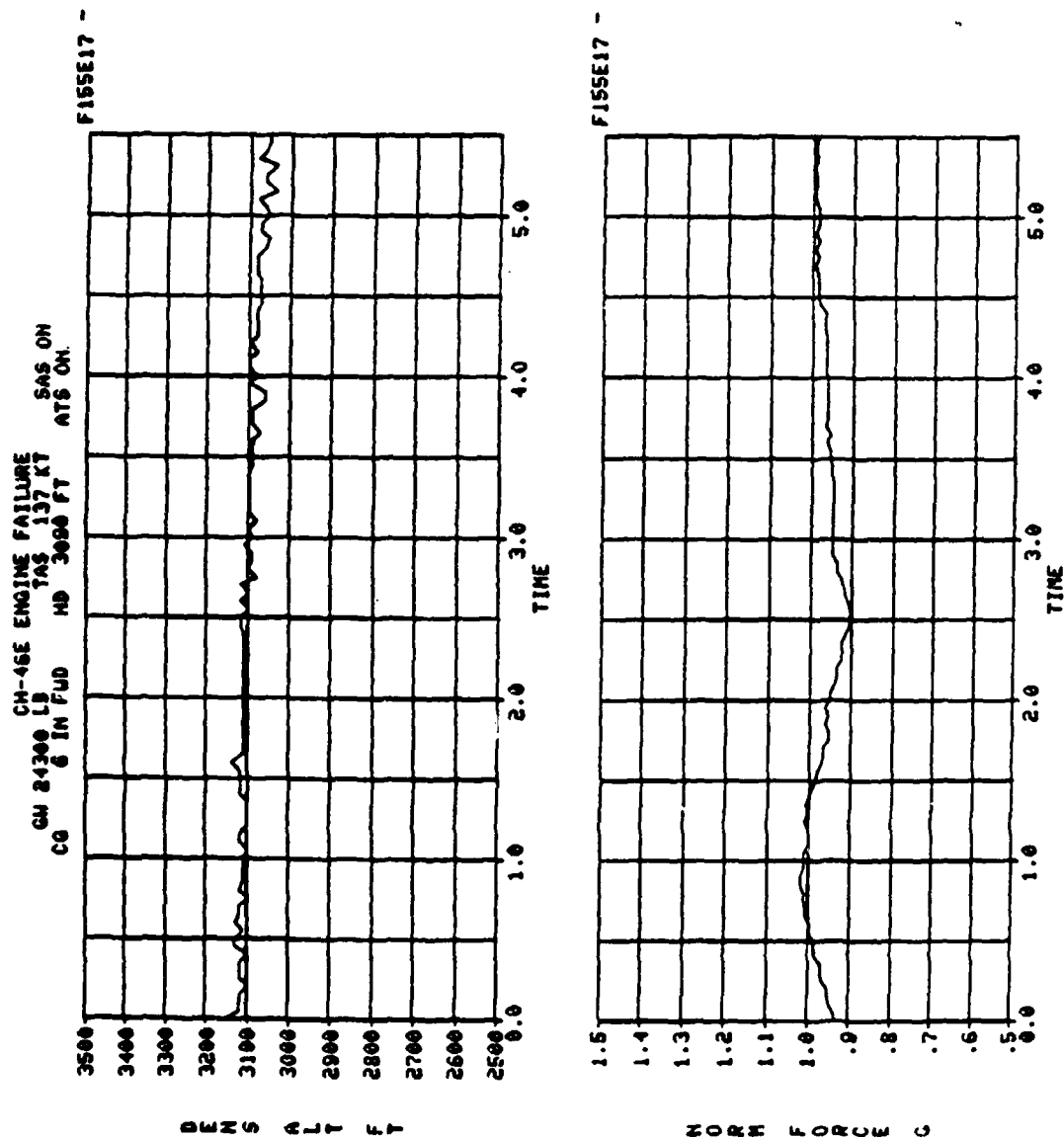


FIGURE 25C

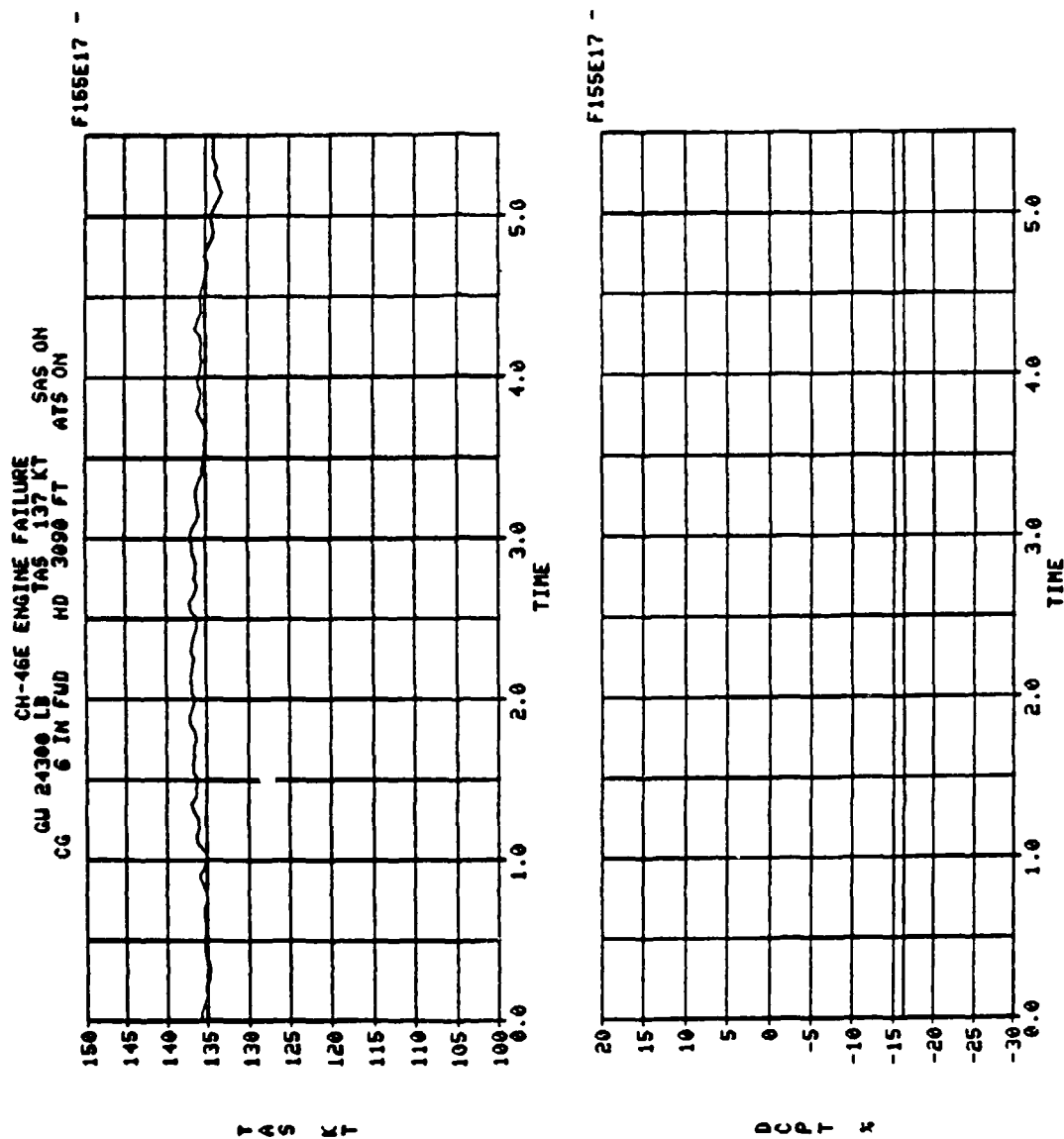


FIGURE 25D

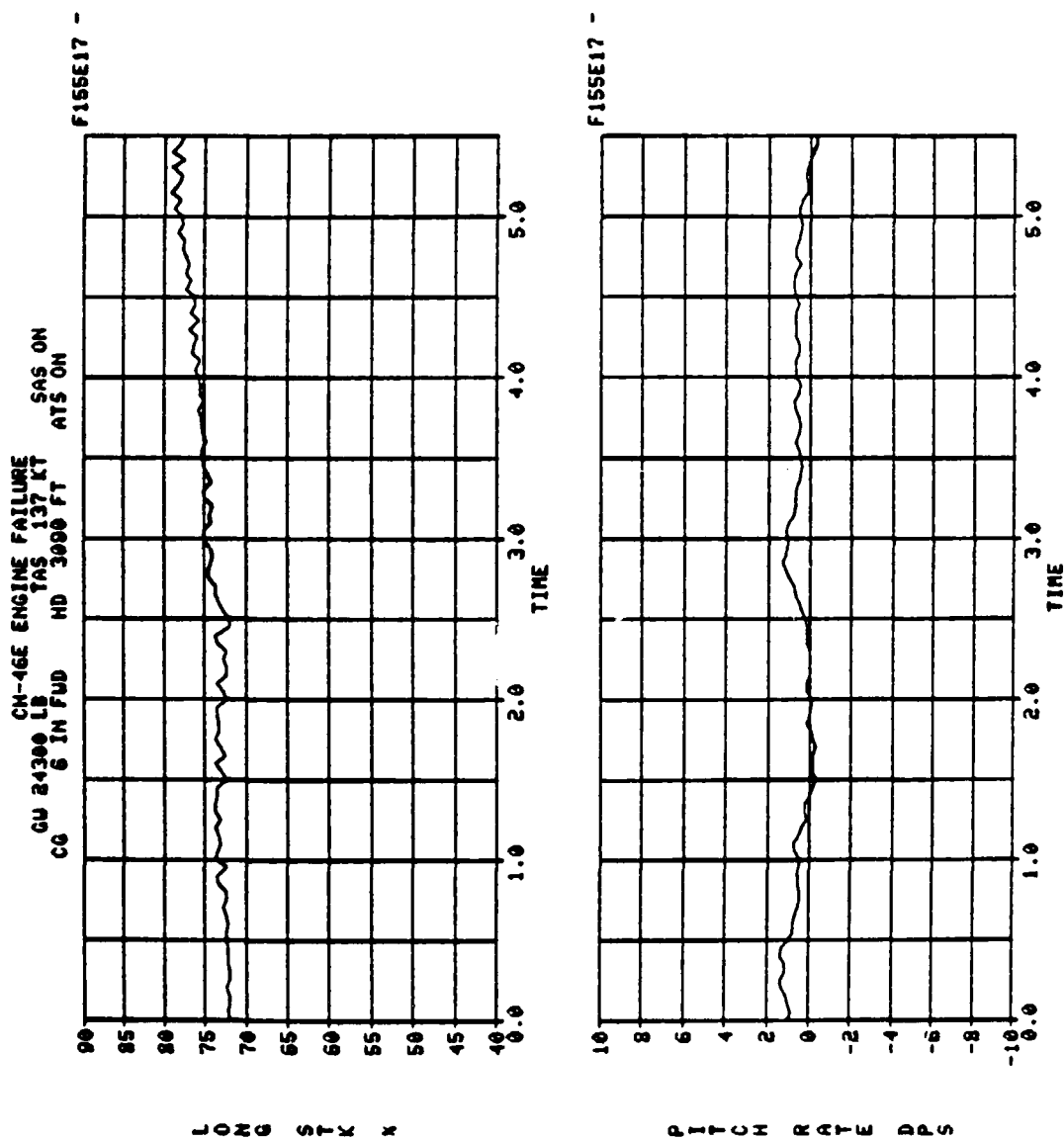


FIGURE 25E

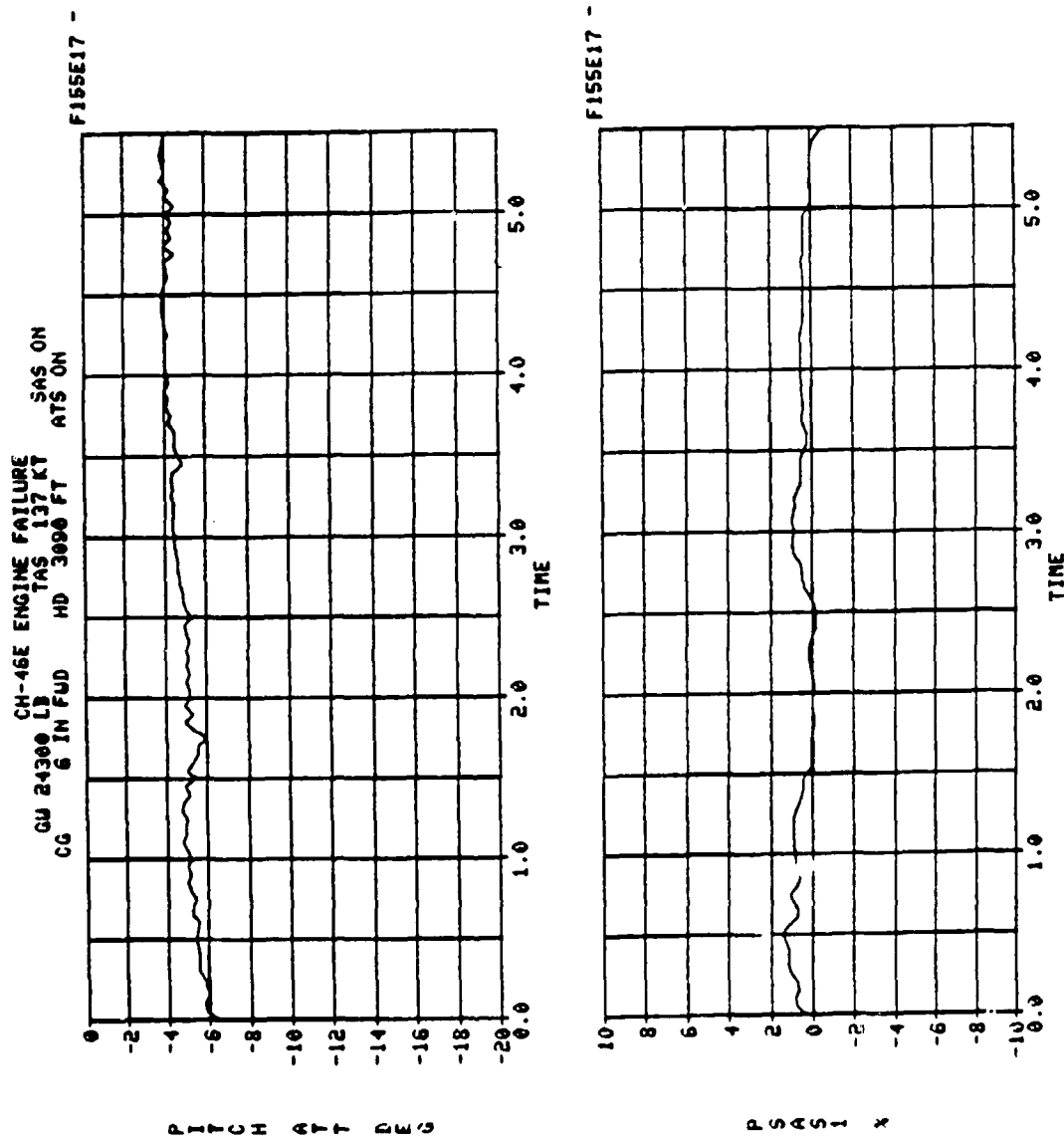


FIGURE 25F

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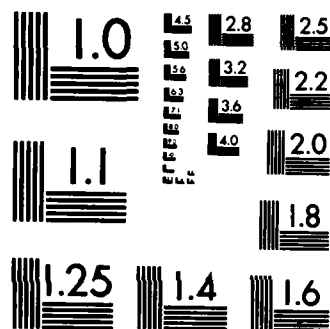
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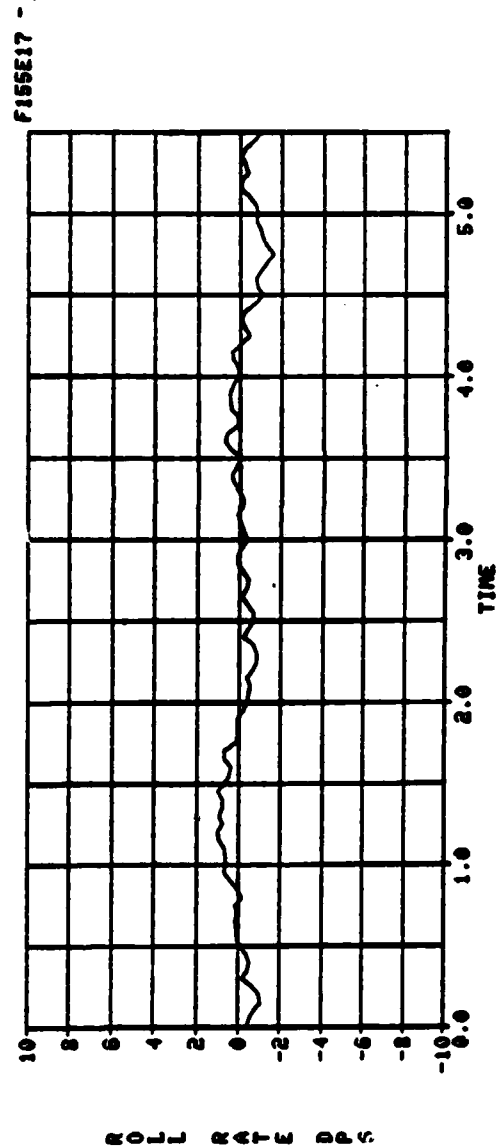
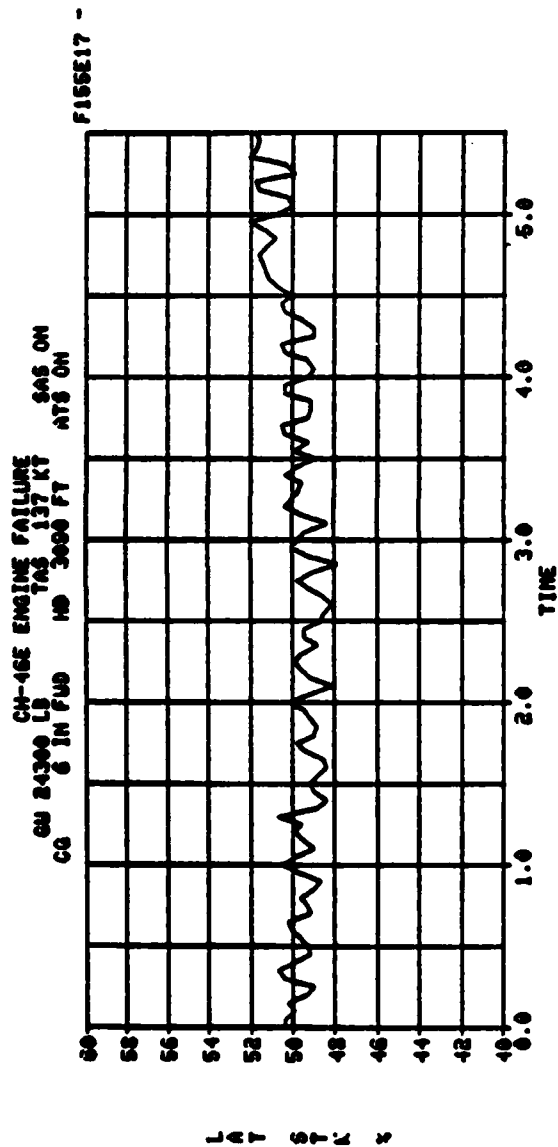


FIGURE 25G

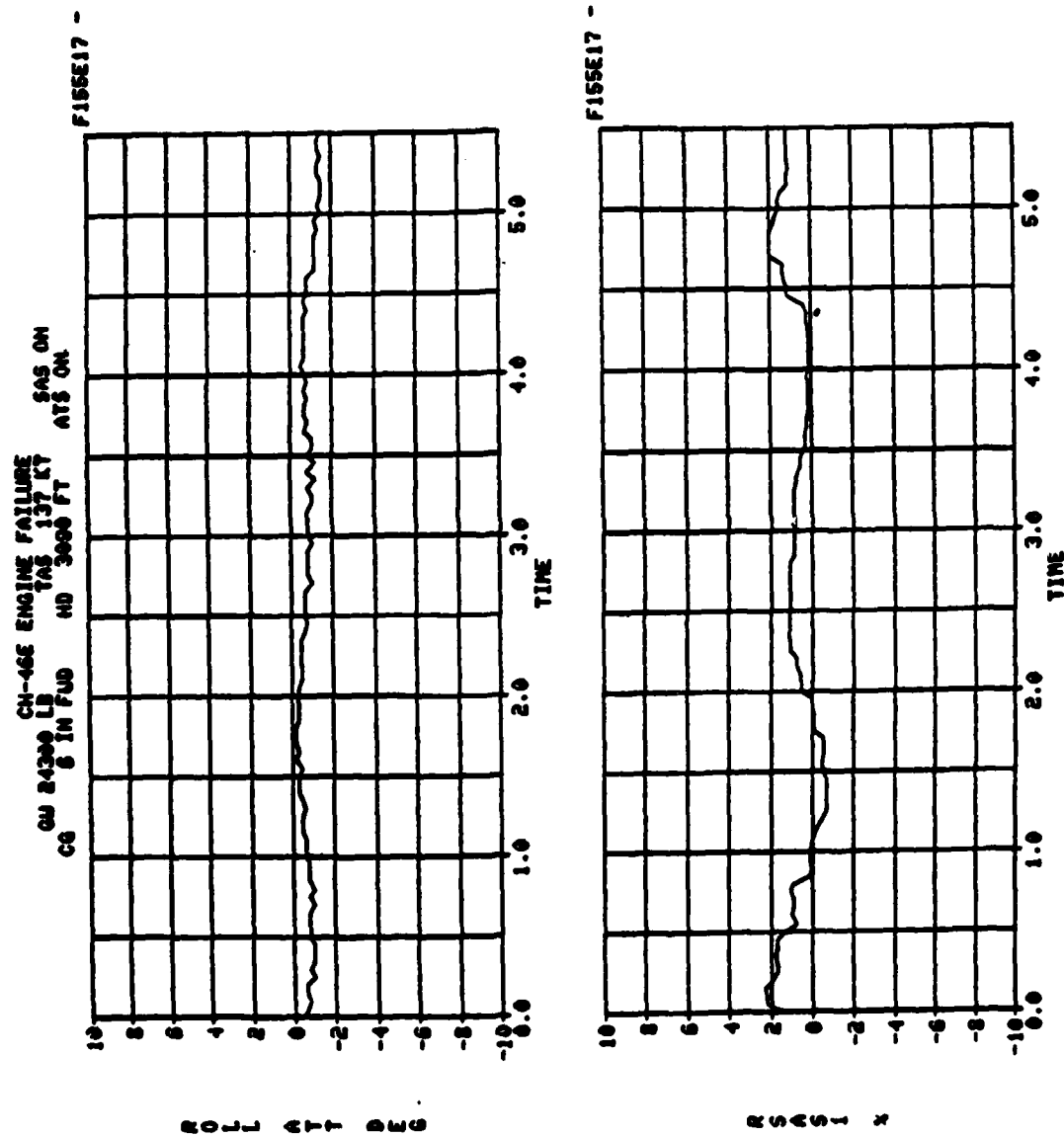


FIGURE 25H



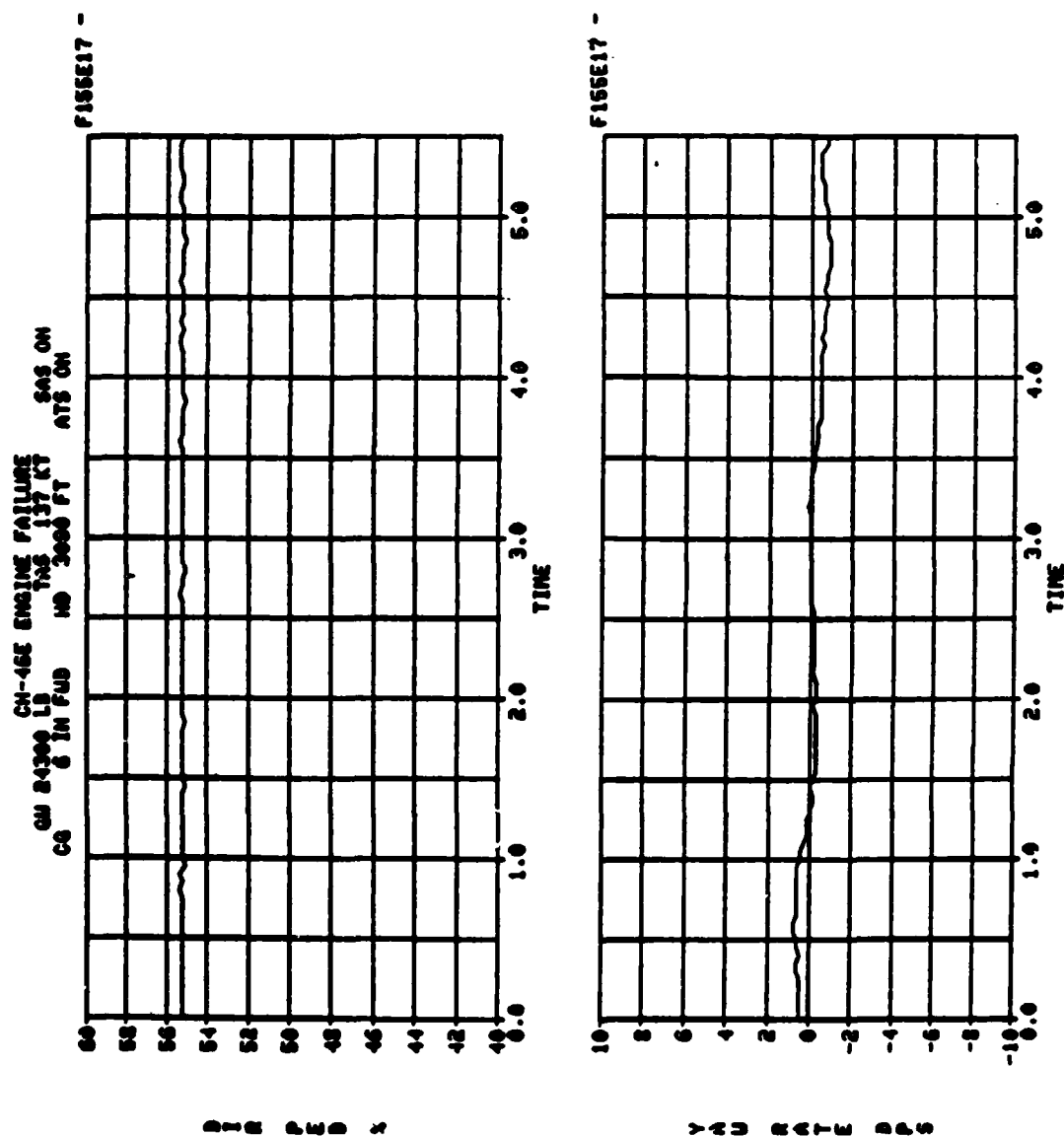


FIGURE 25I

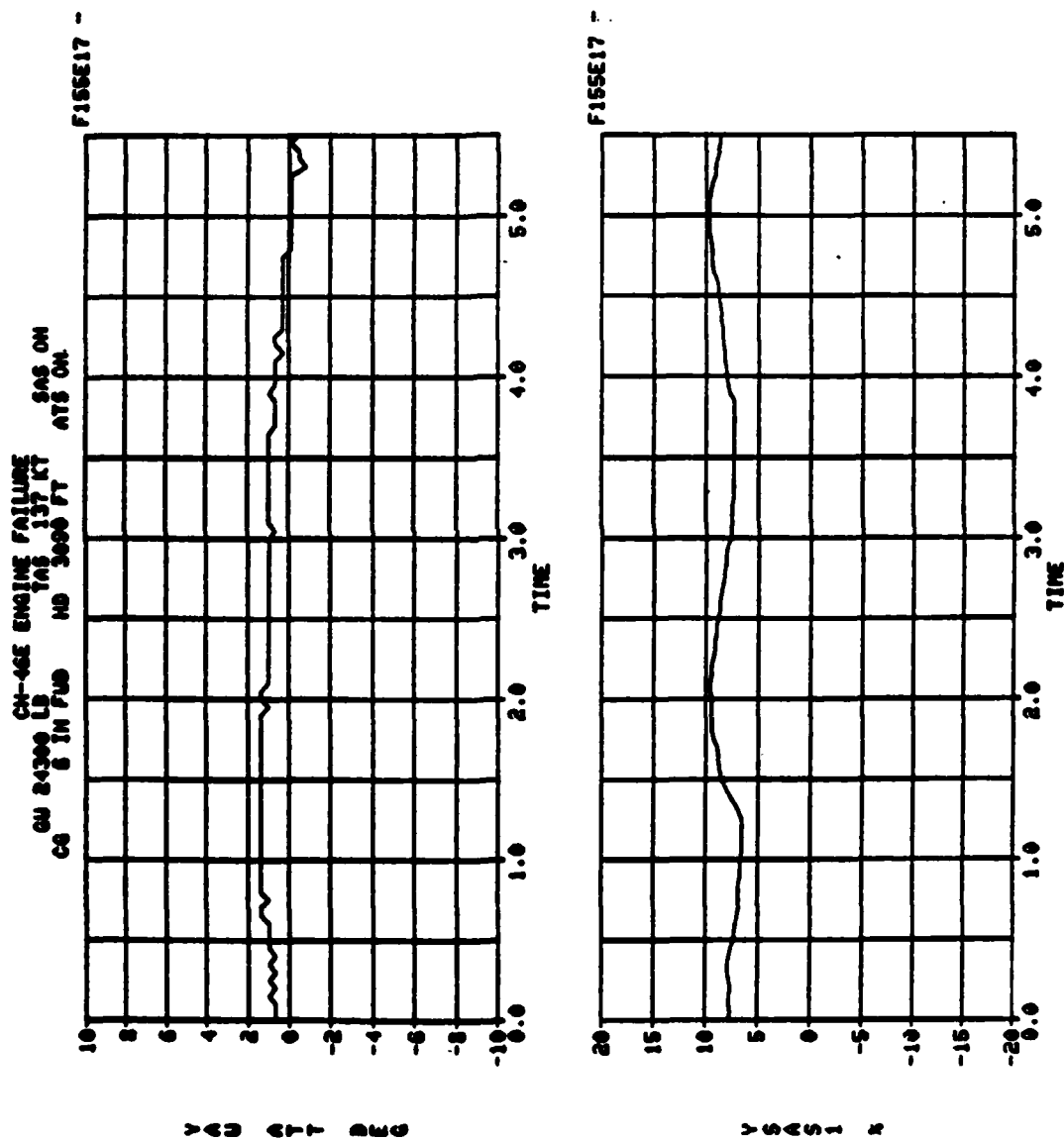


FIGURE 25J

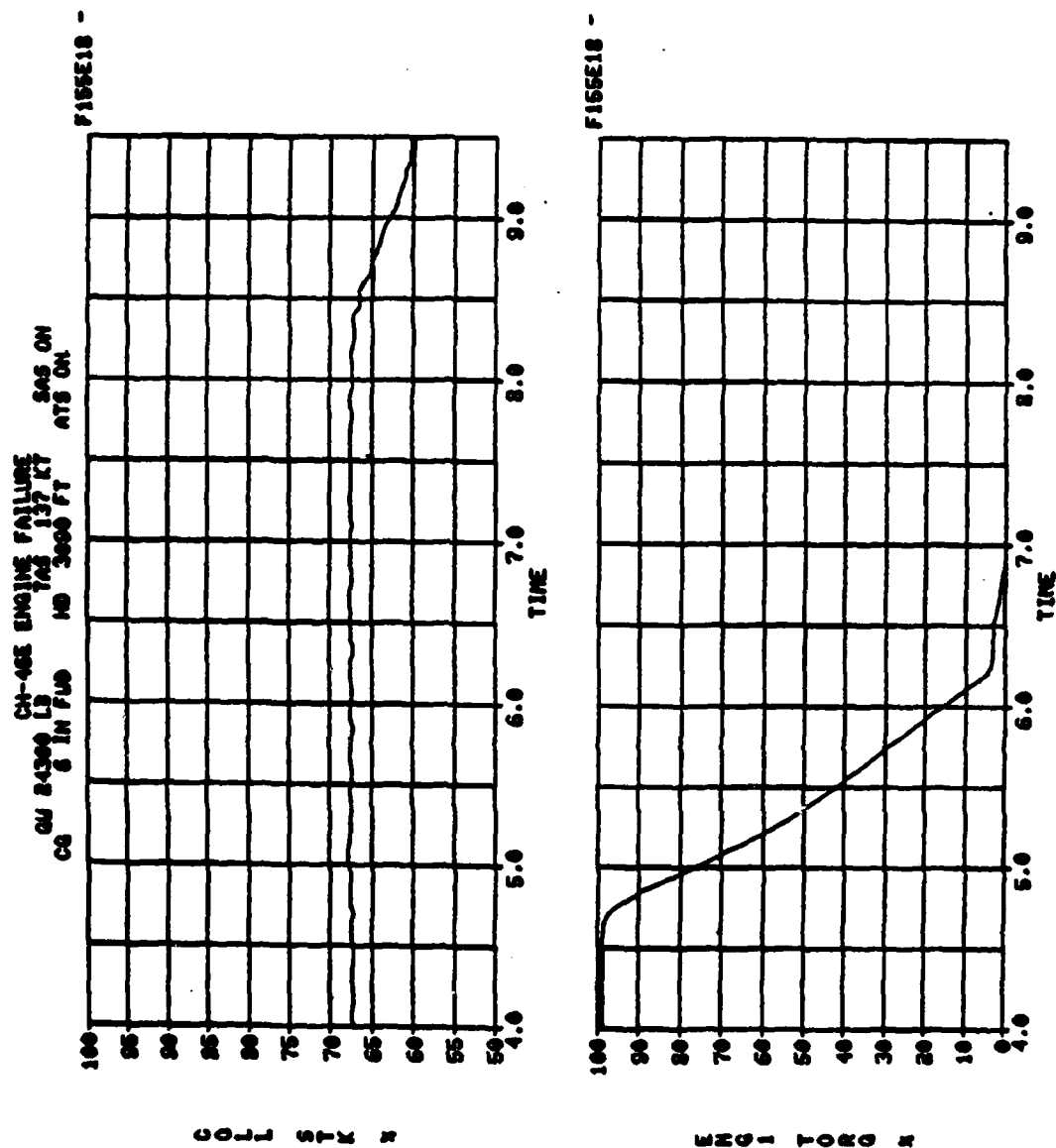


FIGURE 26A

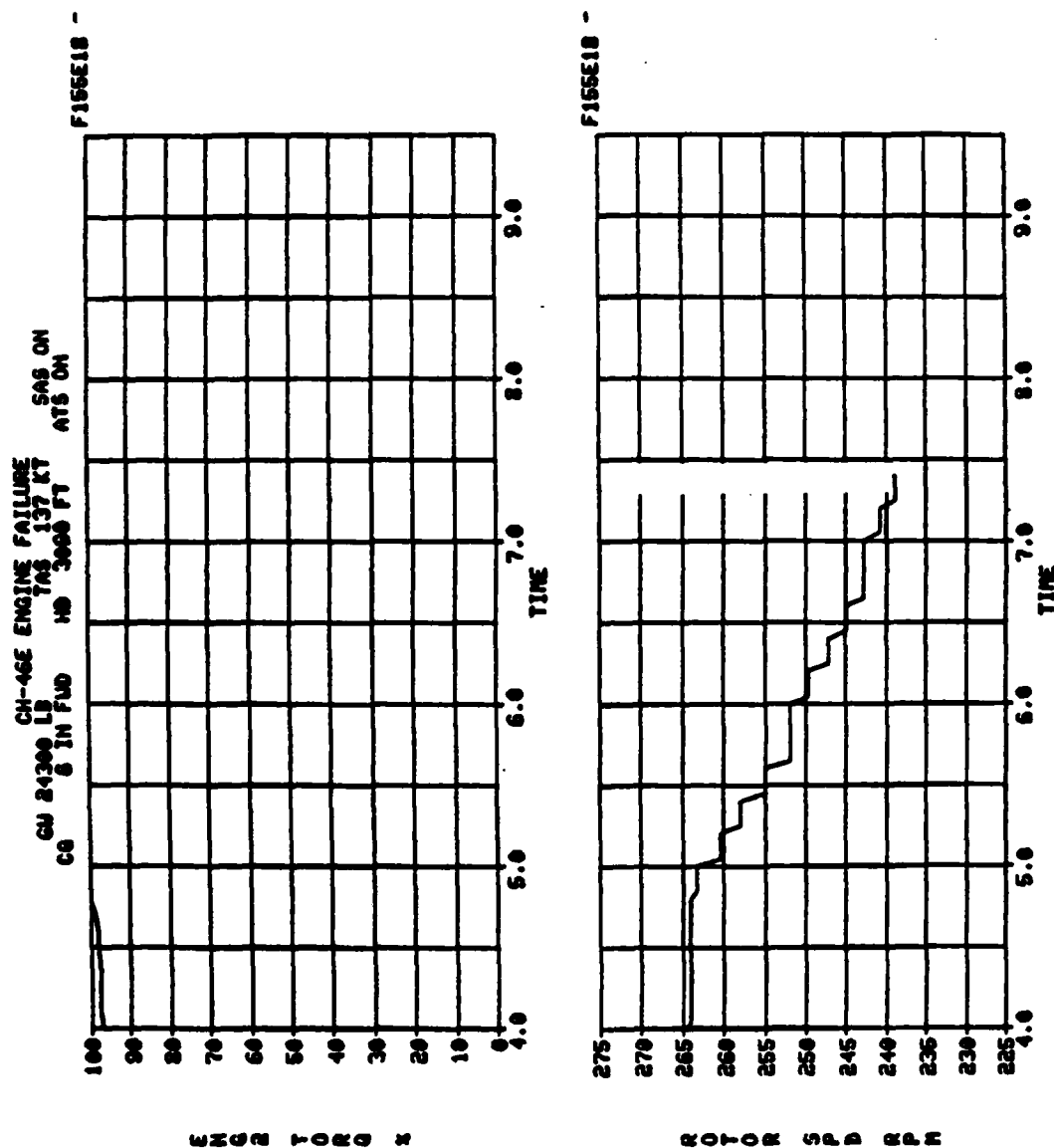


FIGURE 26B

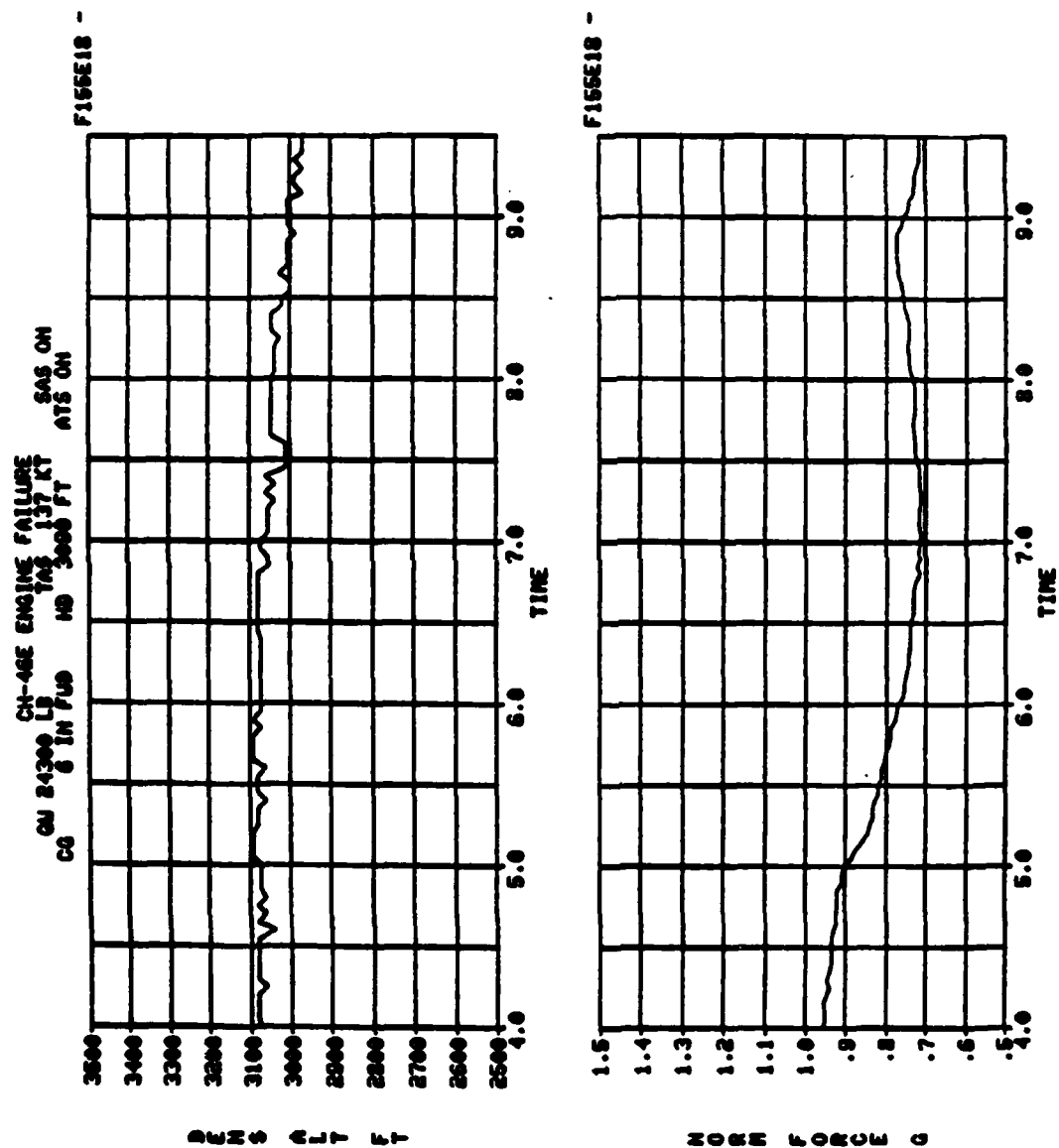


FIGURE 26C

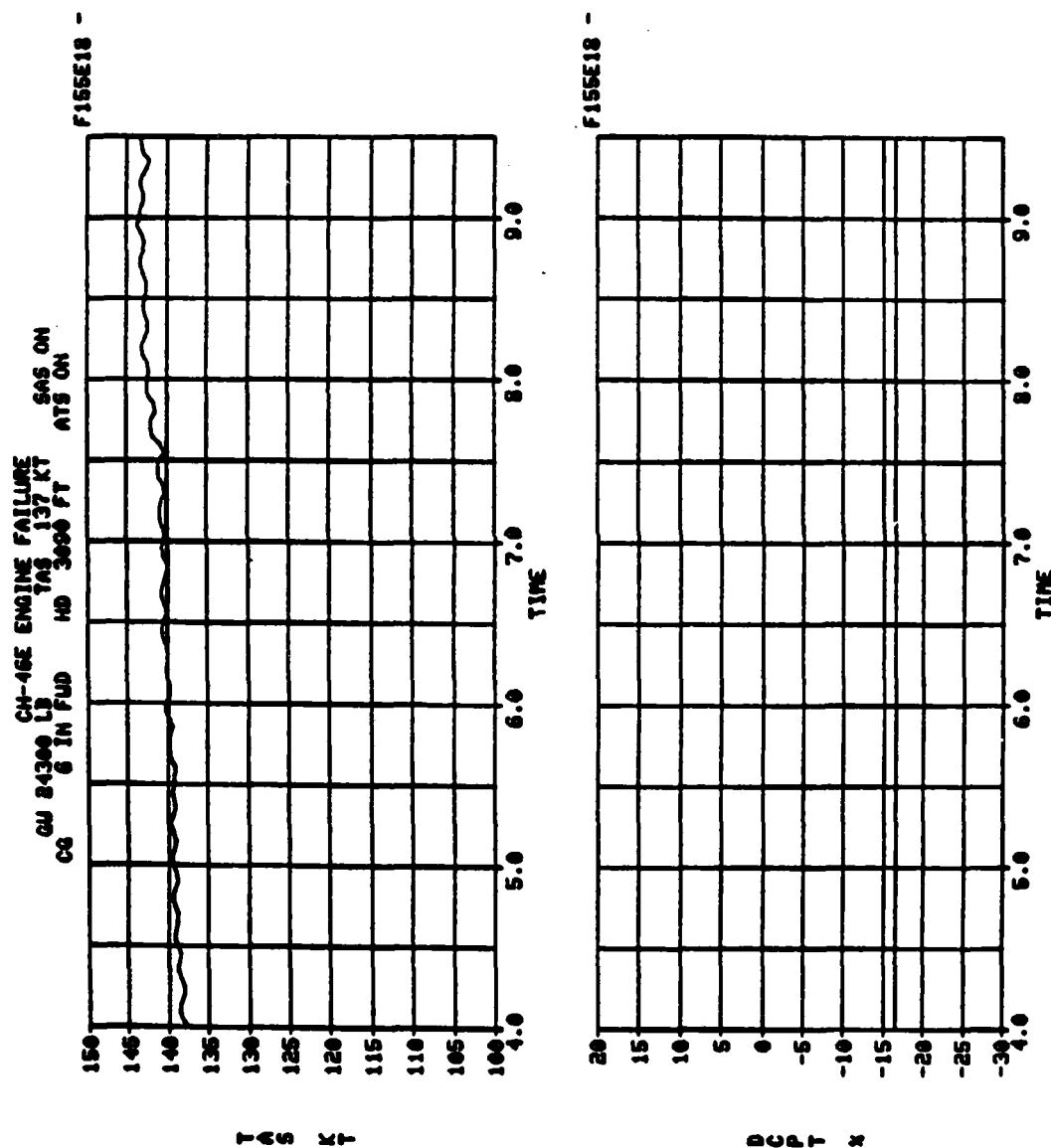


FIGURE 26D

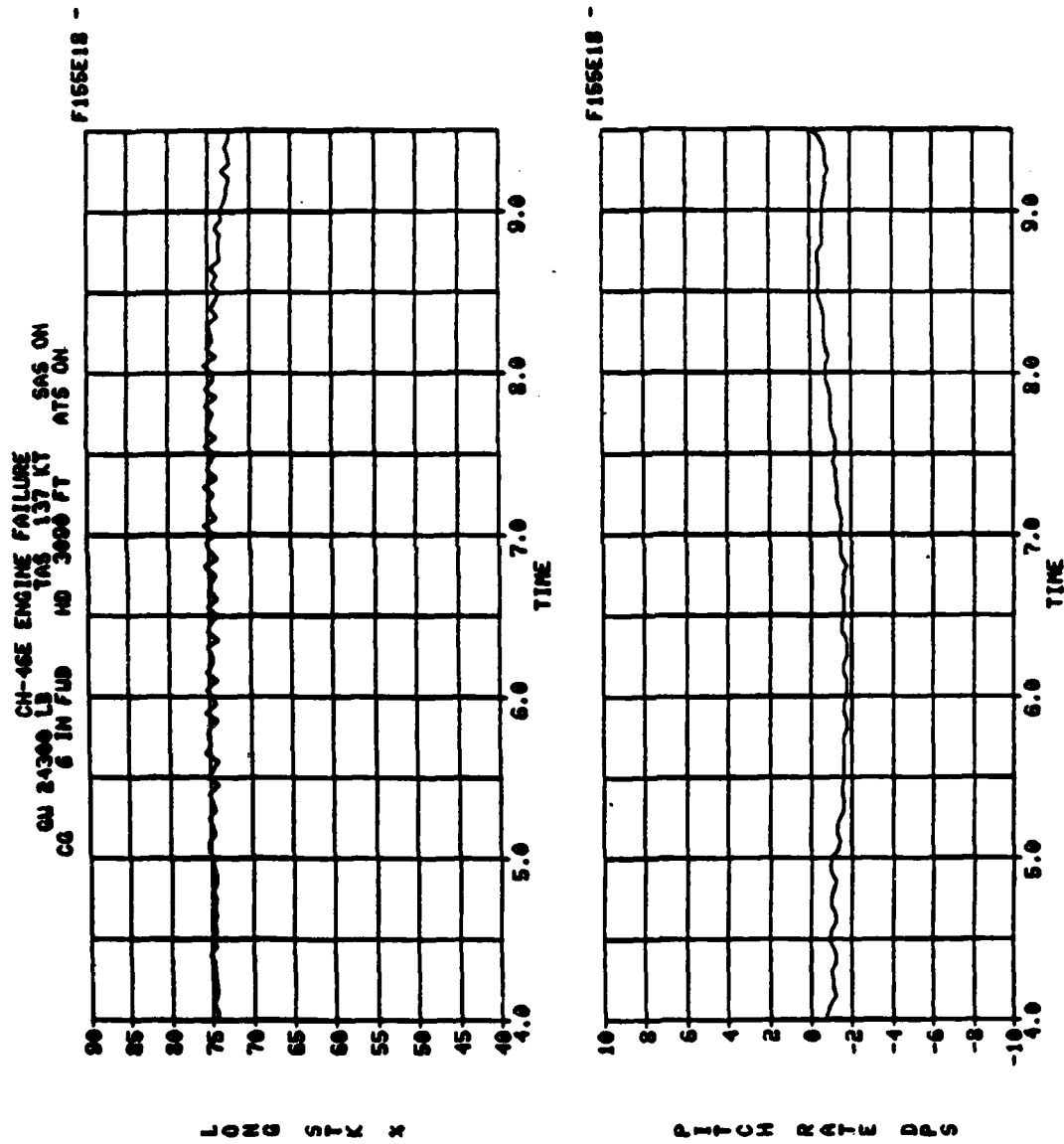


FIGURE 26E

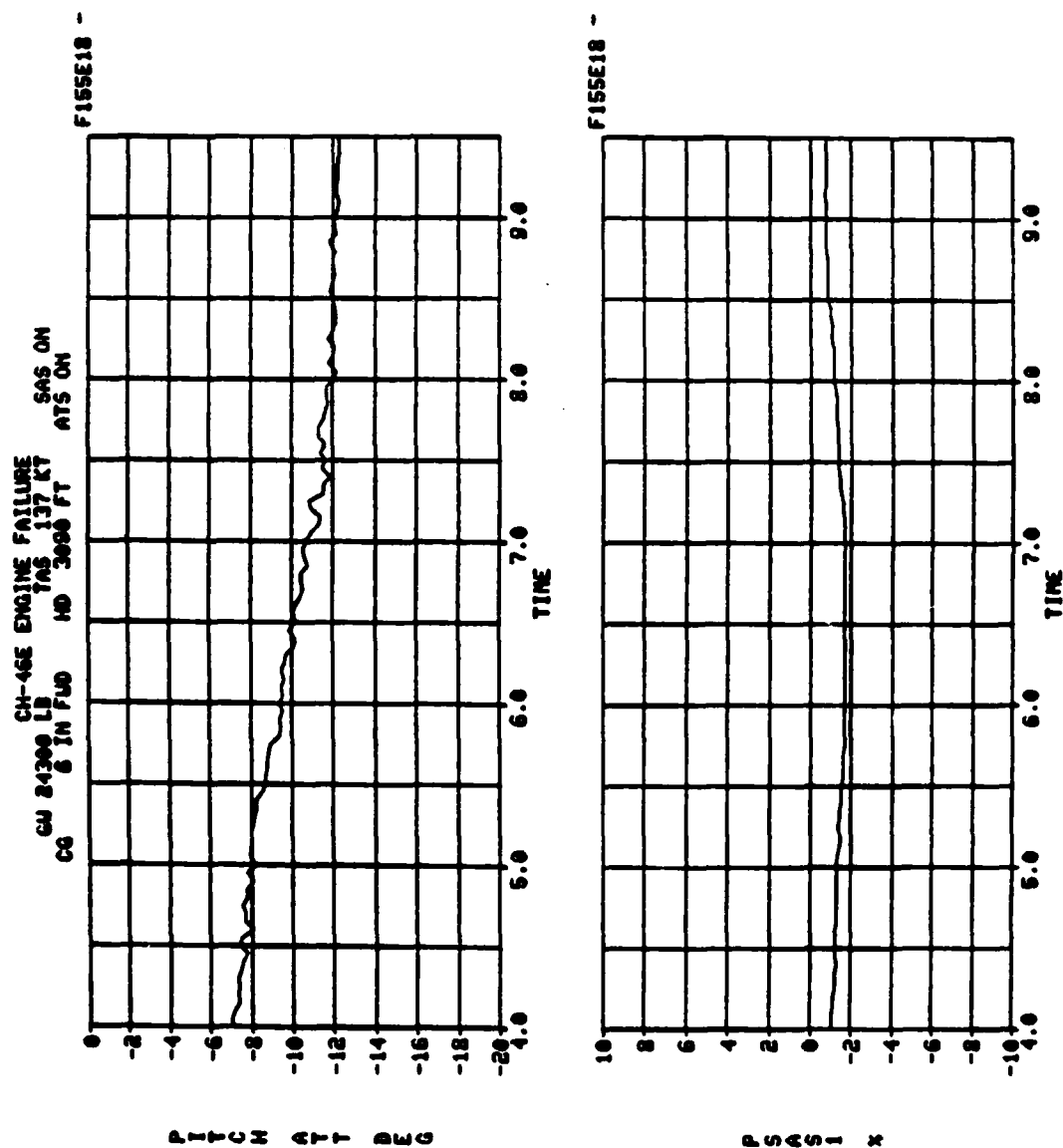


FIGURE 26F



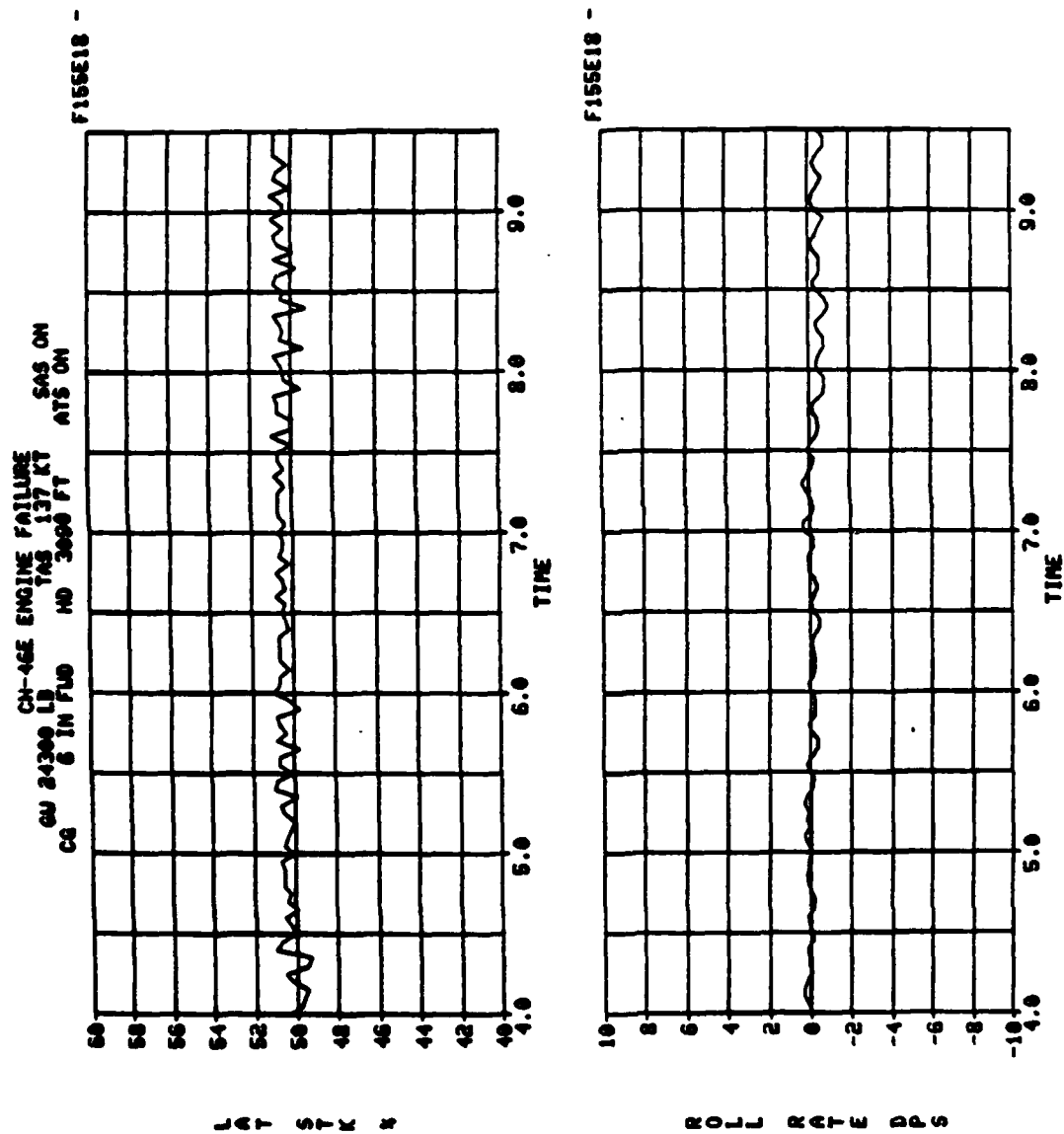


FIGURE 26G

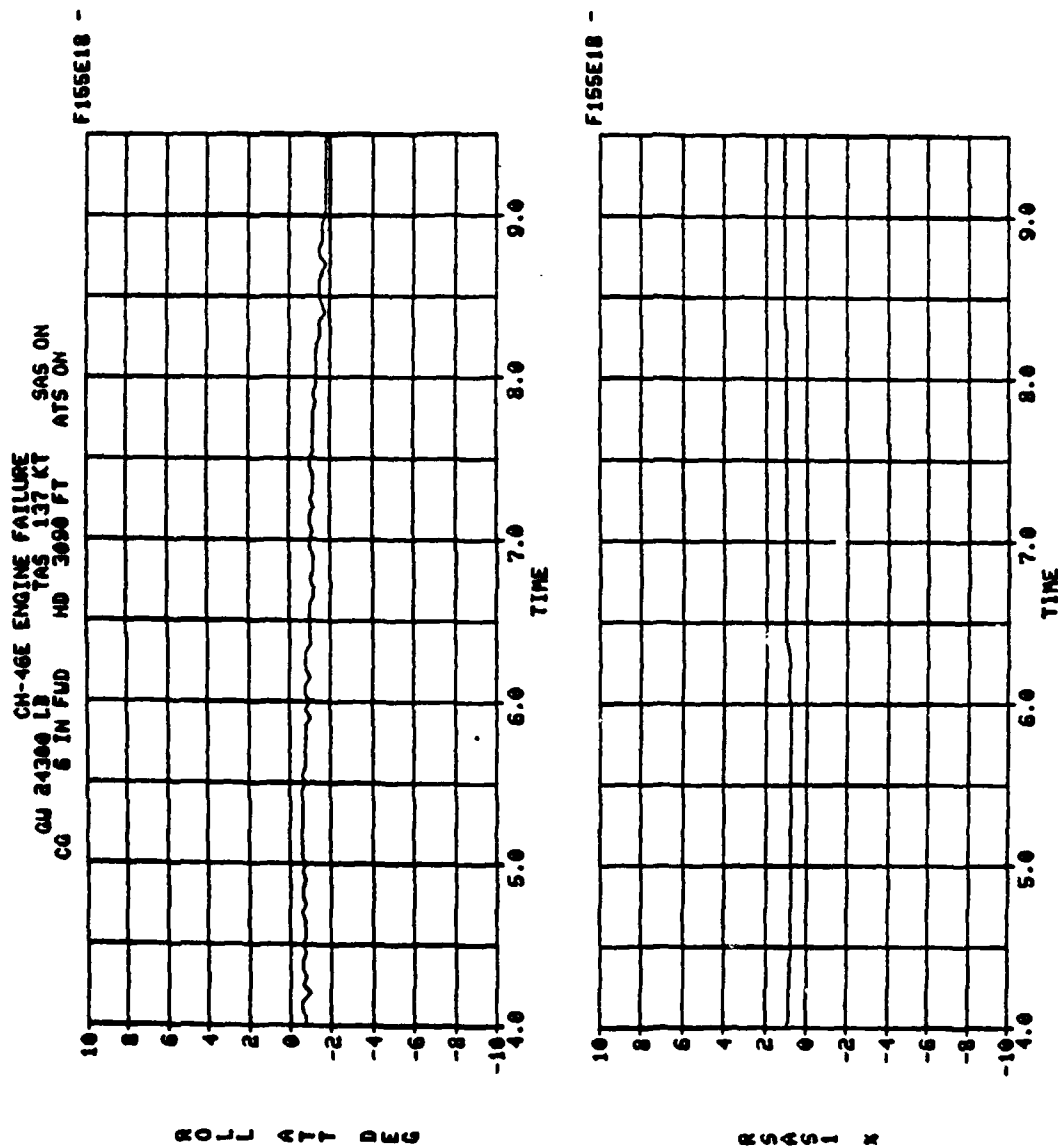


FIGURE 26H

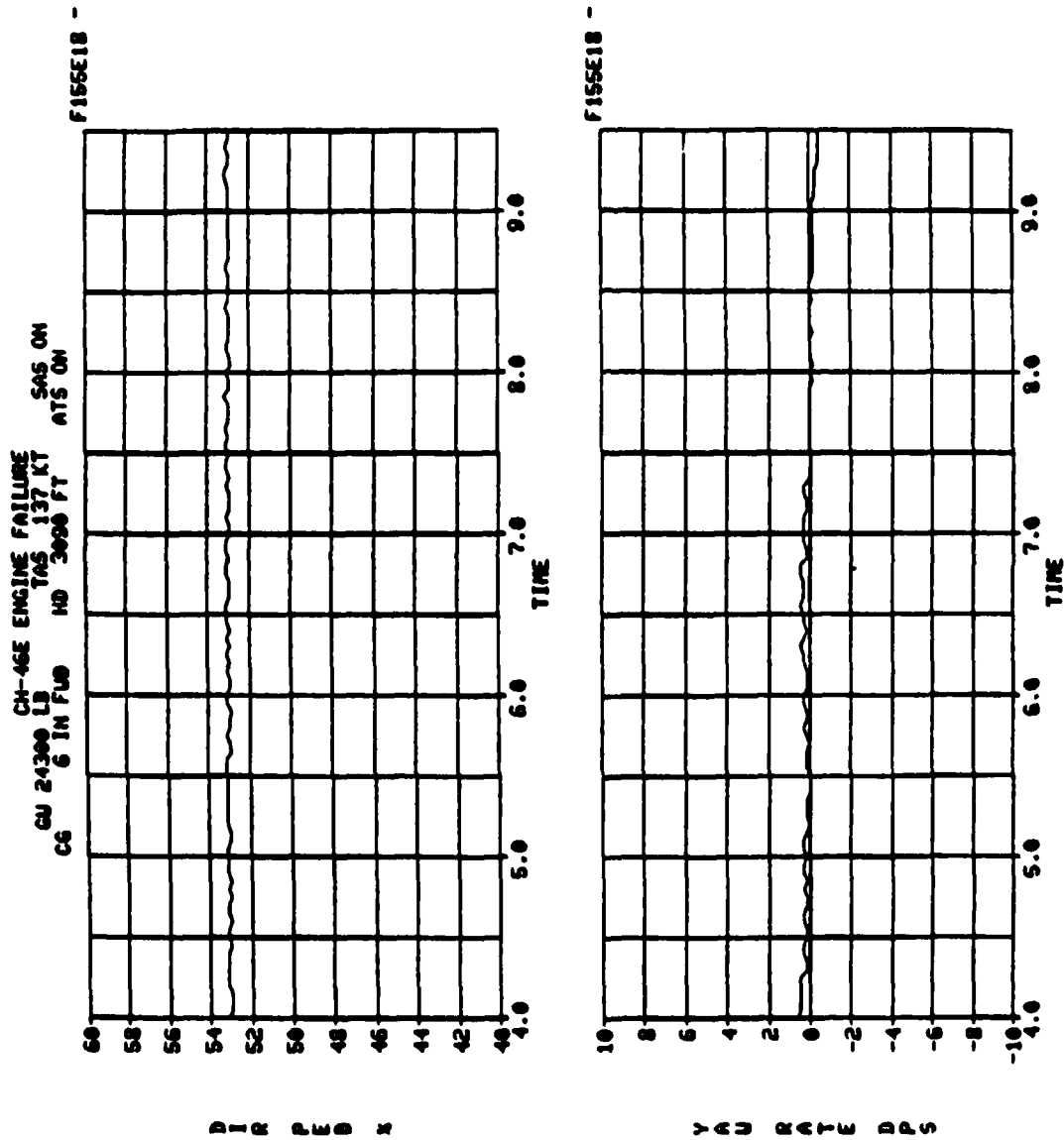


FIGURE 261

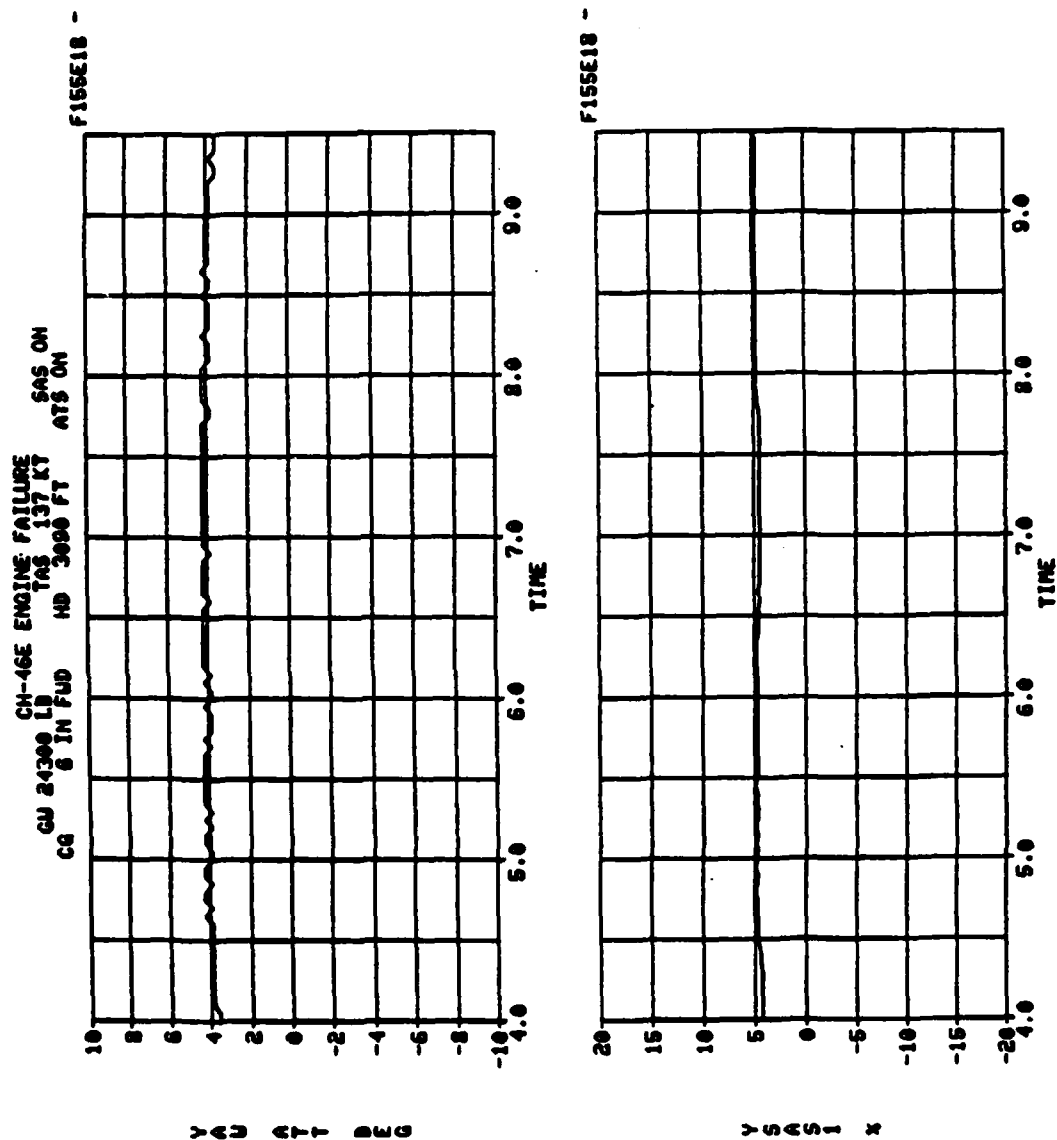


FIGURE 26J

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